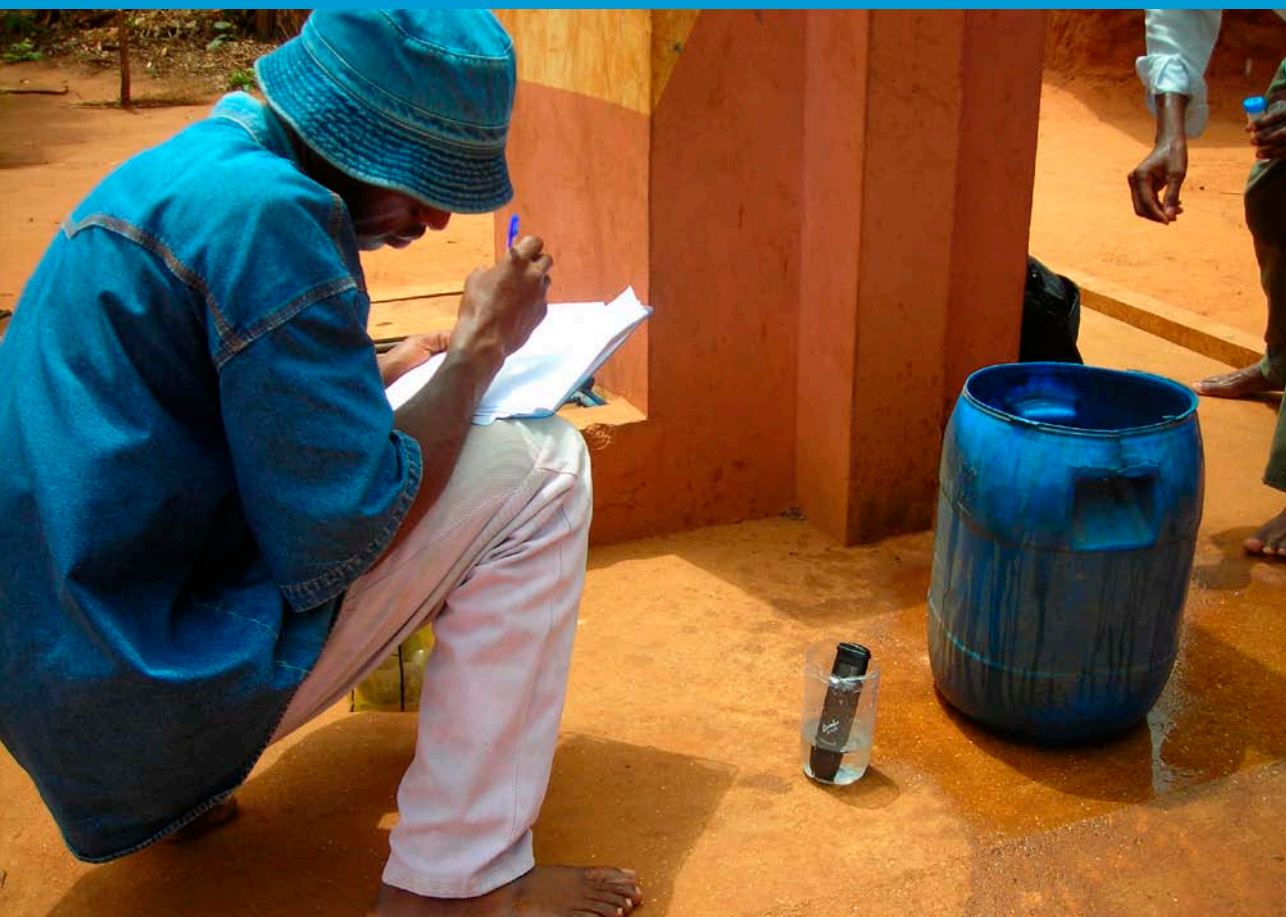
Impact evaluation of drinking water supply and sanitation programmes in rural Benin

The risk of vanishing effects



Impact evaluation of drinking water supply and sanitation programmes in rural Benin

The risk of vanishing effects

November 2011

Preface

Support to water supply and sanitary facilities has been a priority for international development co-operation for many years. Current attention is guided by the international consensus on the Millennium Development Goals (MDGs). MDG 7 includes the target to reduce by half, in 2015, the proportion of people without sustainable access to safe drinking water and basic sanitation.
Benin is for both the German and Dutch government a partner country to which major support to rural water supply and sanitary facilities has been provided. The Policy and Operations Evaluation Department (IOB) of the Netherlands Ministry of Foreign Affairs and the Evaluation Department of the German Federal Ministry for Economic Cooperation and Development (BMZ), in close cooperation with the Evaluation Department of the KfW Entwicklungsbank, conducted a rigorous impact evaluation of rural water supply and sanitation programmes in Benin. The impact evaluation covers several interventions to which a number of donors have contributed. In addition to Germany and the Netherlands, other main donors were multilateral banks, France and Denmark. Support provided has been aligned to national sector policies and harmonized between donors.

The objective of the support to water supply and sanitary facilities goes beyond sustainable access: 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 study seeks to determine whether these effects materialize. Special attention is devoted to compare water quality between sources and to identify the linkages between water use, sanitation and hygiene behavior. In addition, the report addresses costs aspects of water and sanitation interventions, and reviews some major organizational challenges to reinforce sustainability.

There is a worldwide consensus on the potentially positive impacts of programmes for water supply and sanitary facilities; conventional evaluation studies do not, however, normally quantify the realised net effects. This impact evaluation therefore uses a combination of quantitative and qualitative methods and techniques and a quasi-experimental design, supplemented by a small experiment. Through such an evaluation we also wish to explore different approaches to assess the net effects of these programmes. By accompanying the roll-out of a large government programme, supported by various donors, with this impact evaluation we hope to contribute to a more evidence based management. For the Netherlands the study belongs to a series of impact evaluations of water supply and sanitation programmes in different countries.

Rita Tesselaar of IOB was overall responsible for the evaluation, in coordination with Michaela Zintl, Head of the BMZ Evaluation Department, and Prof. Dr. Eva Terberger of the KfW Evaluation Department. The main research consultants for the study were Youdi Schipper, Assistant Professor of development economics, VU University Amsterdam; Isabel Guenther, Assistant Professor of development economics, Swiss Federal Institute of Technology (ETH) Zurich, and Thea Hilhorst, senior institutional assessment consultant at the Royal Tropical Institute, Amsterdam. The household surveys and focus group

discussions were implemented by Esaie Gandonou, Assistant Professor of agricultural economics, University of Abomey-Calavi; Guy Nouatin, senior lecturer of sociology, University of Parakou, and Elena Gross, PhD student of development economics, University of Göttingen. The water quality tests were conducted by the IMPETUS laboratory, Parakou.

The study benefited from comments received earlier, most notably from the Benin authorities for the water sector and for hygiene and basic sanitation, Kreditanstalt für Wiederaufbau (KfW), German International Cooperation (GIZ), Carel de Groot and Camille Dansou of the Netherlands Embassy in Cotonou, Dr. Christine Sijbesma of the IRC International Water and Sanitation Centre, the chair of the reference group Henri Jorritmsa and Antonie de Kemp of IOB and Dick van Ginhoven and Rob Swinkels of the Dutch Ministry of Foreign Affairs. Special thanks are due to Carel de Groot and Camille Dansou for their information, advice and support throughout the study. Thanks are also due to all informants and last but certainly not least, all the respondents to the survey questionnaires and participants of focus group discussions.

IOB and BMZ bear final responsibility for the contents of the report.

Prof. Dr. Ruerd Ruben,
Director Policy and Operations Evaluation Department (IOB)
Ministry of Foreign Affairs
The Netherlands

Michaela Zintl,
Head of Evaluation Department
Federal Ministry for Economic Cooperation and Development (BMZ)
Germany

Table of contents

List of Figures

List of Tables

List of Boxes

Acronyms and abbreviations

AEV	adduction d'eau villageoises (small piped water supply system)
AFD	Agence Française de Développement
AUE	association d'usagers d'eau (water user association)
BPO	objectives-based programme budget
BMZ	German Federal Ministry for Economic Cooperation and Development
CEPEP	Centre d'Encadrement des Petites et Moyennes Entreprises
CeRPA	regional centre for agricultural development
DALYs	Disability-Adjusted Life Years
Danida	Danish International Development Agency
DD	double difference
DED	Deutscher Entwicklungsdienst (German Development Service)
DG Eau	Direction Générale de l'Eau (water directorate)
DH	Direction de l'Hydraulique (previous water directorate)
DHAB	Direction de l'Hygiène et de l'Assainissement de Base (Directorate for Hygiene and Basic Sanitation, Ministry of Health)
DHS	Demographic and Health Survey
EMICoV	Integrated Modular Survey on Household Living Conditions
EPE	equivalent water point
FADeC	fonds d'appui au développement des communes (fund to support municipal development)
FCFA	franc de la Communauté Financière Africaine (West African CFA franc)
FPMH	drilled boreholes equipped with manual pumps
GDP	gross domestic product
GIZ	German Agency for International Cooperation
GTZ	German Agency for Technical Cooperation
IDWSSD	International Drinking Water Supply and Sanitation Decade
ImS	social intermediation
IOB	Inspectie Ontwikkelingssamenwerking en Beleidsevaluatie (Dutch Policy and Operations Evaluation Department at the Ministry of Foreign Affairs)
KfW	Kreditanstalt für Wiederaufbau (German development bank)
MDG	Millennium Development Goal
MEE	Ministère de l'Eau et de l'Energie (Ministry of Energy and Water Engineering)
NGO	Non-governmental organization
PADEAR	Programme d'Appui au Développement du Secteur de l'eau et de l'Assainissement en Milieu Rural
PADSEA	Programme d'Appui au Développement du Secteur de l'Eau et de l'Assainissement (Danida-supported)
PEP	Programme Eau Potable (drinking water programme)
PFM	Public Finance Management
PHA	Promotion de l'Hygiène et de l'Assainissement de Base (campaign for basic hygiene and sanitation)

PNHAB	Programme National d'Hygiène et d'Assainissement de Base (Benin's basic hygiene and sanitation programme)
PPEA	Programme Pluriannuel d'appui au secteur de l'Eau et de l'Assainissement
S-Eau	Service Eau (local government water services)
SONEB	Société Nationale des Eaux du Bénin (urban water company)
UNDP	United Nations Development Programme
UNICEF	United Nations International Children's Emergency Fund
USAID	United States Agency for International Development
WHO	World Health Organization
WSS	Water supply and sanitation

Main findings and issues

Introduction

In the period 2008–2010, the Evaluation Departments of the Netherlands Ministry of Foreign Affairs and the German Federal Ministry for Economic Cooperation and Development in cooperation with KfW Entwicklungsbank jointly conducted an impact evaluation of the rural water supply and sanitation programmes in Benin being supported by the donor community. The supported programmes aim to contribute to the achievement of the 7th Millennium Development Goal target 'to reduce by half the proportion of people without sustainable access to safe drinking water and basic sanitation by 2015'. The purpose of the impact evaluation is to account for the substantial support provided for rural water supply and sanitation (WSS) programmes in rural Benin as well as to be a useful reference for water supply and sanitation policy development in the future. The study has been undertaken in close consultation with Beninese authorities and partner organizations, particularly the DG Eau, Hygiene and Basic Sanitation Authority (DHAB- Ministry of Health), the Netherlands Embassy and German development cooperation in Benin.

German development cooperation has been active in the Beninese WSS sector since the late 1960s, while Dutch development cooperation has supported the sector since 2003. The focus of the programmes in the rural sector has been on the expansion of water supply infrastructure, mostly hand pumps or foot pumps and small piped systems (AEVs). The interventions analysed in this study are partly financed by the Programme Pluriannuel d'appui au secteur de l'Eau potable et de l'Assainissement (PPEA), which runs from 2007 to 2012 and is supported by the Netherlands. German support for investments in water and sanitation programmes in Benin is EUR 8 million annually on average, complemented by technical assistance (GIZ, formerly GTZ and DED, contribute about an additional EUR 2.5 million per year). The partners being supported include SONEB (urban water supply) and the DG Eau (rural water sector). Dutch support for WSS programmes that have been realised up to 2011, amounts to EUR 33.3 million, of which approximately 70% has been provided for rural water supply and sanitation.

The focus of the study is on the impact of the programmes at the level of the end beneficiaries. Main effect variables taken up in the impact analysis are quality and quantity of the drinking water that is supplied and consumed, the actual use of improved water sources and sanitation facilities, hygiene behaviour, the time burden of water collection, the use of time savings for schooling and/or economic activities, the health effects and costs, and the financial viability of the investment and fee structure. The study also addresses differences in benefits across socio-economic groups, and differences between the dry and rainy season. The study has been designed with the explicit aim of providing quantitative evidence on the effects that can be attributed to the interventions by comparing changes over time and between households with (treatment) and without (control) programme interventions. The interventions studied are water supply infrastructure (manual pumps and small piped systems), public latrine buildings and

hygiene promotion. The impact study has been organized in four *départements*[1], Mono and Couffo in the south, Collines in the Centre and Borgou[2] in the north-east. The choice of *départements* was based on the following criteria: a) that they are covering areas that are supported by, among other donors, German and Dutch development cooperation; b) the availability of infrastructure planning data; and c) geographical and ecological variation.

The study further entails a qualitative assessment of the sustainability of the interventions and their beneficial impacts. The assessment addresses relevant institutional factors, linked as they are to society's governance and politics, and economic, financial, institutional and environmental determinants of sustainability.

Data for the impact analysis and sustainability assessment have been collected through document review, large-scale locality and household surveys, focus group discussions and interviews with key stakeholders and other informants.

Main findings

1 **A considerable share of new water points is allocated to localities with more than one improved water point and already adequate service levels, being mostly larger and wealthier localities. Realisation rates of projected new water points are modest. Nevertheless, Benin is on track to achieve its MDG coverage target for improved rural water points.**

Forty per cent of the localities in the sample that received a new water point in 2009 gained first-time access to an improved water source. However, 38% of realised water points had been allocated to localities with more than one improved water point already and with adequate service levels as defined by the DG Eau (with fewer than 50 households per improved water source). Before the installation of the new water point these localities were not disadvantaged in terms of distance to the existing sources for the average household. Larger localities and localities with wealthier households are more likely to use an improved water source.

The 2008 and 2009 water infrastructure realisation rates (realised water points/planned water points) in the two *départements* in the impact study appear low (50% to 60%) and delays are quite common. Borgou, one of the three original survey areas, was even dropped from the study because the realisation of infrastructure was so low that an impact analysis would not have been meaningful.

Like for any other developing country, the target for Benin is to halve by 2015 the proportion of the population without access to safe drinking water. With the baseline for the rural population set at 35% in 1990, the Government of Benin has set a target of 68% for 2015. At the start of the study, a majority of households in the sample (62% for the control group and

[1] Medium size administrative unit.
[2] As Borgou showed low implementation rates in 2010 the analysis concentrated on data from the two other localities mentioned.

52% for the treatment group) in the sample was already using an improved source, in spite of modest realisation rates.

2 **The provision of new water points leads to a substantial increase in the use of improved water points as the main source of drinking water, both during the dry season and the rainy season and both for non-poor and poor households. It also substantially increases the number of litres per capita per day collected, although poor and large households consume less per capita. Nevertheless, a considerable share of households continues to use traditional water sources, instead of or in addition to the newly installed water point.**

The baseline data from 2009 presents use of an improved water point as the main source of drinking water at 52%. The provision of new improved water points leads to a 30 percentage point increase (up to 84%) in the number of households using an improved source as their main source of drinking water. For households in localities that are provided with an improved point for the first time, the increase in the use of improved water point is even steeper, rising from 0% to 76%. Given a mean locality size of 81 households, this leads to 57 households being served with a first water point in a locality. The effects of a new water source on the use of improved water sources for drinking water in the rainy season (+26% for general access and +66% for first-time access) are very similar to the dry season impact.

The percentage of households that use drinking water exclusively from improved water points only increases from 42% to 63% for any new water point and from 0% to 51% for first-time access, respectively. Hence, a considerable share of households continues to use a traditional water source for drinking (38% in 2010). This percentage includes both households whose main source is unimproved (28% on average in 2010) and households with an alternative source that is unimproved and used for drinking. Some households in treatment localities do not switch to an improved water source at all. The reason most frequently cited by households for not using an improved water point is that it is too far away or, less frequently, too expensive. No difference is found in the use of newly installed water points within localities between non-poor households and poor households.

After installation of a new water point, the quantity of water collected and transported to the dwelling from an improved source increases by 9 litres per capita per day (a 50% increase). In the case of first-time access, this impact is 23 litres per capita per day (from a baseline level of zero water from an improved source). Total water quantity consumed from improved and traditional sources increases by 7 litres from a baseline of about 30 litres per capita per day (a 20% increase). Poor households consume significantly less water per capita than non-poor households and the same applies to larger households and households with children under the age of five.

3 **At source, water from improved sources is of much better quality (in terms of E. coli contamination) than water from traditional sources. However, this quality difference practically vanishes at point of use as a result of recontamination during transport and storage. Rainwater at point of use has the same quality as water at point of**

source from an improved source. The impact of water point installation on point-of-use quality is thus close to zero. Improved and new household storage containers strongly reduce point-of-use E. coli contamination.

Samples from water sources show a strong correlation between E. coli contamination and the technology of the water source. Some 3% of public taps, 13% of manual pumps, 36% of improved wells, 58% of traditional wells and 80% of surface water sources are contaminated with E. coli. However, during the dry season, these differences vanish once water quality is measured at the household source. For all types of water sources, 30% to 40% of households' water storage containers are contaminated with E. coli. The impact analysis also shows that in rural Benin – during the period studied – water point installation had a negligible effect on the quality of the water actually consumed. Factors that explain contamination of clean source water include unhygienic practices around the water points and during the transport and storage of water, as well as possible mixing of water from different sources. Water tests during the rainy season confirm that rainwater collected and stored by households has the same quality as water from an improved water source at point of source.

An experimental intervention which provided water storage containers with a spigot and 'closed' transport containers – both intended to reduce hand-to-water contact – showed a strong reduction of E. coli contamination at point of use. It thus appears that provision of better water supply should be complemented by measures that safeguard quality at point of use. Public and private initiatives for water treatment, such as chlorination of water sources, have been undertaken, but on an ad hoc basis. There is no system in place to ensure a regular check of drinking water quality, including water produced by AEVs.

4 **A new water point considerably reduces the time taken to collect water, particularly for communities that have obtained an improved water source for the first time. However, water collection time is still substantial in many localities because of queuing. As women bear the responsibility of water collection in households, it is mostly women who save time. Time saved is mostly spent on housework and on economic activities that may provide income.**

The impact analysis, based on self-reported and measured distance, indicates that the construction of a new water point brings the main water source about 100 to 230 metres closer to the household. This rather modest reduction in distance would not sufficiently explain the considerable time savings of on average 14 minutes per round trip for collecting water (21 minutes for first-time receivers of new water points) after a water intervention. A new water point does, however, also reduce population pressure per water point, and hence reduces queuing time at the water points. Average collection time per round trip remains substantial – even in treatment localities – at on average 38 minutes per round trip. Queuing takes up about half this time, especially in larger villages. For the rainy season, no time savings were found, as many households collected rainwater before and after the interventions.

The time savings per day amount to 23 minutes for all interventions and 54 minutes for first-time access, which translates into 140 hours (17.5 days[3]) and 329 hours (41 days) of time savings per year per household respectively.

Eighty per cent of individuals engaged in water fetching are women. Every third household even sends a girl under the age of 16 to collect water. Hence, women should benefit most from the time savings achieved. Time saved is mostly spent on housework. Only 35% of women report that they use the time gained for income-generating activities. Based on this result, it is estimated that an average household's income in a locality with a new water point increases by about 0.7%. This is in line with another study that has shown that economic benefits from productive use of time gained through water interventions need to be linked with economic projects for women.[4]

5 Benin is severely lagging behind its target for latrines, both with regard to access and use. Lack of cleaning and maintenance are the biggest problems in increasing the use of public latrines. Households' willingness to pay is substantially below the reported costs of constructing a private latrine.

In 1990, 8% of the population used an improved sanitation facility. The MDG target is hence that by 2015, 56% of the population should use an improved and private latrine.[5] But in 2008, still only 20% of the population had access to improved sanitation. For the rural population, the percentage in 2008 was as low as 4% (UNICEF–WHO, 2010). The conducted survey data indicate a large difference between reported access to a latrine and actual use. Whereas about 12% of households have access to a public latrine, only 2% of households reported actually using a public latrine. Even though there is a big difference between public toilet access and use, a newly installed public toilet increases toilet use by 50%. This suggests problems of maintenance (cleaning and emptying) of public latrines in the long term. About 8% of households reported that they use a private latrine. And 10% of households with children under the age of five practise safe disposal of faeces from babies or infants and do not leave them in the open.

Investment costs for private latrines are in most cases fully born by the households and are reported to be around EUR 150 per household. Many households in the survey sample indicate that high costs of constructing a private latrine is a major obstacle to improved sanitation access. The mean willingness to pay for investments in private latrines is estimated at EUR 50, which is one third of the reported cost.

3 An eight-hour working day is assumed.

4 Sijbesma, C., Verhagen, J., Nanavaty, R., and James, A. J. (2009)

5 Furthermore Benin set its target at 100 % school coverage with improved sanitation. Institutional latrines do not fall under the internationally agreed definition of access to improved sanitation. Coverage for rural households is still very low.

6 The impact analysis did not find evidence for an effective integrated water supply, sanitation and hygiene-promotion approach. Safe hygienic behaviour is not widespread and did not change much over the period studied. The lack of an effective integrated strategy is partly explained by institutional factors.

Despite the intended systematic inclusion of sanitation and hygiene in the rural drinking water strategy since 1992, this component continues to receive low priority during resource allocation and implementation. Only 35% (10%) of localities that received a new water point in 2009 reported that they hosted a health worker (project) that started to work on issues related to hygiene and sanitation in the same year. Moreover, no significant effect of previous years' hygiene interventions on households' water handling was found. Only 2% of households showed safe water disposal practices, and as mentioned above, only 10% with children under five take proper measures to dispose of children's excrement and do not leave it in the open. Whereas more than 50% properly cover the water storage container at home, only 20% cover it during transport and only 25% have a separate storage container for drinking water. About 10% treat – e.g. with boiling, filtration or chlorine – the water before consumption. A worrying result of this impact analysis is that households stop water treatment once they start using an improved water source.

The Ministry of Health does not give priority to hygiene and sanitation. Responsible key institutions in rural water supply, the DG Eau, water departments, and municipalities, are, as compared to water supply infrastructure, much less attuned to hygiene and sanitation interventions. Some municipalities have started to address hygiene and sanitation issues in the context of pilot support programmes, developed with the assistance of donors (Danida and BMZ through GIZ). However, the study could not prove any significant effects of these activities so far. The envisaged transfer of hygiene assistants from the Ministry of Health to the municipality is expected to enhance engagement of municipalities in hygiene promotion. However, various informants expressed the view that when setting priorities for allocating scarce resources, these are more likely to go to new water installations, followed by contracting out of management to get the taxes in. Municipalities are even less likely to invest in an integrated water, hygiene and sanitation approach.

7 There is no impact of an improved water source on water related diseases (at least within a year and for the diseases analysed), even though diseases like diarrhoea are still highly prevalent in rural Benin and pose a high economic burden on households. Improved household transport and storage systems are found to reduceself-reported vomiting.

Given that hygiene practices are not widespread in Benin, that reported water quantities were already relatively high at baseline and that improved water sources do not lead to an increase in water quality at point of use, it is not surprising that no impact of an improved water point on (self-reported) diarrhoea, vomiting or abdominal pain is found – even though all of these diseases are highly prevalent in rural Benin, both among children and adults. 40% of households reported having at least one member suffering from diarrhoea within the last four weeks. Hence the water-related disease burden remains high.

Households spend, on average, about FCFA 30,000 on the treatment of diarrhoea per year, or 3% of a household's yearly income. An additional 39 adult working days are lost due to diarrhoea, leading to an additional income loss of about FCFA 39,000. An improved water source in combination with improved water storage containers, lowers the percentage of households with a child (household member) suffering from vomiting within the last four weeks by 4 (6) percentage points. This is a considerable reduction given that in 2010, on average 'only' 7% (15%) of households had a child (household member) suffering from vomiting within the last four weeks. There is also some evidence that projects on hygiene and sanitation have a positive effect on reducing self-reported vomiting.

8 In general, most improved water points collect water fees, which are, however, not always paid by the households. This income from the water points is usually enough to cover maintenance and basic repair costs but is not sufficient to cover the cost of the replacement of infrastructure. If households only consumed improved and paid-for drinking water, they would have to pay a ratio of their income that is equal to, and for poor households partly above, the willingness- and ability-to-pay that was estimated across several developing countries in previous research.

Comparing daily reported with daily calculated revenues from the water points, about 20% to 30% of water containers collected from a water point are either not paid for by the households or they are paid for but the revenues are not kept for the operation of the water point. Per water point, a maximum amount of EUR 750 is collected per year. Hence, cost recovery of investments, at least for manual pumps, seems unlikely, whereas maintenance is guaranteed (at least from a financial point of view). AEVs generally vary in network size, in their investment costs and total revenues and hence cost recovery cannot be calculated easily. Given that most improved water points (about 85%) collect water fees, whereas unimproved water sources usually do not, a newly installed water point increases the water fees paid by households that switch from a cost-free open source to a costly improved water source by about FCFA 10 to FCFA 20 per water container. It is estimated that an average (poor) household has to spend about 1% to 4% (3% to 7%) of its annual income on water consumption, if all water consumed is collected from an improved source and is paid for. Several studies across countries have shown that the estimated willingness-to-pay for improved drinking water is between 1% and 5% of annual income. The UN (UNDP, 2006) even sets the ceiling at 3% of household income to make water affordable to the poor.

9 The rural water supply and sanitation strategy has a clear focus on sustaining water supply infrastructure. However whereas sustainability of water supply services under the previous community-based strategy was not fully ensured, sustainability of the current strategy is also not ensured because it is under pressure from various mostly institutional and economic constraints.

The sustainability assessment was conducted during a period of reform following the approval of the second national strategy for rural drinking water provision in 2005. Sustainability is defined as the (probability of) continuation of benefits after major development assistance has been completed. The second national strategy shows a

changing perspective on ensuring the sustainability of interventions. The old approach of developing adherence and engagement of water users in planning, financing, managing and maintaining water points is abandoned, increasingly also for manual pumps. In line with decentralization laws and reforms, this responsibility is shifted to municipalities, who increasingly contract out management services to private companies. These companies have to pay tax and a contribution to a fund for the replacement of water supply infrastructure. The first strategy has resulted in the acceleration of the establishment of water points and the improvement of sustainability of the water points. However, sustainability is currently not fully ensured. The challenge of the second strategy will be to ensure that sustainability is indeed achieved.

For the current strategy, the assessment of sustainability of interventions may seem premature. However, experience suggests that a number of factors commonly influence the sustainability of rural water supply and sanitation interventions, and therefore it is useful to identify their presence or absence at an early stage of strategy implementation. These include technical factors (such as the durability of infrastructure, operation and maintenance), economic factors (such as willingness and ability to invest and pay for services), and environmental factors (such as groundwater availability). Linked to these sets of factors, the structure, capacities and performance of institutions are major determinants of the sustainability of rural water supply and sanitation interventions. These institutional factors, linked as these are to society's governance and politics, are most influential.

Survey data analysis shows that the vast majority of rural water points in the sample localities – still mostly the result of the previous strategy – were functioning at the time of the survey. However 57% of the water points have had interruptions with, on average, repairs within 38 days. Of the water points built within the last three to five years, 20% were not in use any more. This high percentage is remarkable. The reported reason why the water point was abandoned was, in 80% of cases, a breakdown of the water point. Reported factors that explain this problem include difficulties contacting a technician resulting in a delay in getting repairs done, insufficient funds for repairs and major repairs, conflict between different user groups and lack of transparency of financial management of water facilities. A substantial part of abandoned water points has been rehabilitated by government supported by donors.

The current rural water supply strategy is as such clear and is accepted by most stakeholders, except for changes in management of water infrastructure, which are controversial at community level and cause conflict. Currently and for the medium term, there are various capacity constraints at the level of municipalities, companies and the water authority that put sustainability at risk. The technical and financial capacity of municipalities to take up a considerable expansion of responsibilities and tasks is still limited. The technical quality of investment in physical infrastructure for rural drinking water supply is not fully ensured. Management contracts for rural water supply facilities are new in Benin and most companies have limited experience. Compliance with contracts by municipalities is not systematically checked and sanctions are not being applied, partly due to a lack of experience on the part of municipalities and companies. Municipalities have relied

heavily on NGOs for facilitation of community participation and hygiene and sanitation promotion aspects, but roles are changing and it is not clear whether these NGO services will be continued after donor funding stops. The current strategy envisages local water user associations to disengage from management and convert into consumer interest organizations but initiatives to ensure that consumers are heard and that their interests are taken into account have, up to now, been limited.

Women continue to play important roles, but their participation in rural water supply structures is low. There are also capacity constraints at the level of the water authority (at *départemental* and central level) in supporting municipalities and ensuring sustained services. Government funding of water supply infrastructure, including rehabilitation, has been constrained by delays in the processing of funds and by under-spending.

The share of the national budget in sector funding has decreased. Decision making on the price of water and on percentages set aside for maintenance and replacement, water tax and profit for management companies is still mostly arbitral. Low profitability of part of the companies contracted to manage AEV water supply facilities, particularly in more remote areas where the population shifts to rainwater when it is available, is a reported concern. More generally, AEV profitability is not assured while this is crucial for keeping management companies interested and for safeguarding the contribution of management companies to a municipality fund for major repairs and replacement of infrastructure. At the time of the study it was not clear whether the funds set aside by municipalities could be protected from 'alternative use'. Furthermore, it is doubtful whether a strategy of trying to ring-fence these funds actually makes sense in a decentralization setting in which municipalities are responsible for a whole range of public services.

10 As a result of insufficient attention given in the existing monitoring system to information on implementation and results at the local level and to links between the local and the regional level, the current rural water supply and sanitation strategy as well as the donor support provided are not adequately based on empirical evidence.

Monitoring systems are in place at national and regional level. The scope of data collected by the *départements* is currently limited to mostly technical and financial data. Data collection at national level informing donors mostly focuses on indicators for national level outputs, transfer and utilization of funds, competency and capacities. Moreover, these data are incomplete, not up to date or there are errors in the monitoring data. Systematic monitoring of interventions and results at the local level in the different contexts in Benin and from the local level upwards does not take place. Timely information on the progress in the installation of water amenities and on their functioning is not captured, which hinders addressing constraints in time. The same applies to information on hygiene and sanitation interventions and on quality of drinking water at source and at point of use. Further, the systems do not capture groundwater availability, which, in a few places, is becoming an issue.

Issues of special interest for follow up:

A number of issues of special interest have been distilled from the study findings. These require follow-up:

1 Inequity in the allocation of water facilities

A recent seemingly positive change is the proposed shift from programming of new water points in response to a community request (demand-led programming), towards the use of objectively established needs. Municipalities are expected to allocate new water facilities based on the existing availability of water points in relation to population density and distance to be covered to reach the nearest water point. This new planning system aims to introduce a kind of minimum service level for access to safe water and contribute to more equitable access to water amenities. Communities with least access to drinking water are supposed to be served first.[6]

2 Contamination of drinking water

Apart from inadequate monitoring arrangements, there are no measures in place to ensure water safety at source and at point of use. 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.

3 Continued very low levels of access to sanitary facilities, and even lower levels of use of such facilities, combined with gaps in hygiene practices relevant to safety of water and proper sanitation

Admittedly, there is rather limited firm knowledge available yet about what works in sanitation in Benin and what does not. A much reported obstacle is the relatively high cost of an improved private latrine that meets the standard definition of an improved latrine. One could therefore learn from similar settings where low-cost latrine programmes have already been successful in improving sustainable sanitation coverage.

4 Bias towards water supply infrastructure

Government of Benin funding and the financial assistance of the donor community is almost fully spent on construction and renewal of water supply infrastructure, while (additional) public water supply infrastructure alone in the current Benin context has little impact on the health of the population. Like other key institutions in rural water supply, municipalities are neither investing sufficiently in water treatment, hygiene and sanitation promotion, nor in the social, economic and environmental aspects of drinking water supply. Taking into account scarcity of resources, the current bias in funding towards water supply infrastructure, as compared to other components and aspects, is problematic. Hygiene and sanitation components are not sufficiently clearly

[6] Reference is made to various GIS systems and the Water Point Mapper developed by WaterAid. The Water Point Mapper is a free tool for producing maps showing the status of water supply services. It is aimed at water, sanitation and hygiene practitioners as well as local governments working at district and sub-district level in sub-Saharan Africa. The Mapper has been designed for use in situations where there is no internet connectivity.

implemented as separate components or as programmes in their own right in areas where enough water for sanitation and hygiene is present.

5 Institutional factors undermining the sustainability of rural water supply infrastructure

The main issues are reported gaps in the enforcement of rules and regulations on tender procedures and services contracts undermining quality of works; ongoing gaps in the availability of technicians and spare parts for maintenance and repairs; limited transparency in the financial management of water facilities undermining the availability of funds for repairs; underdeveloped accountability between actors and levels and at the same time diminishing direct user/consumer voice; lack of timely availability of quality data from monitoring local progress regarding the installation of water amenities and their functioning, which hinders addressing bottlenecks on time. Studies in other countries show that transparency of, accountability for, and influence on services by those who use (women) and pay (women or men or both) are significantly related to degrees of sustainability and use.[7]

6 Economic constraints affecting the sustainability of water supply infrastructure interventions

Most users pay for water, but an element of subsidy for replacement of infrastructure will continue to be required for the foreseeable future. A related issue is the lack of profitability of some of the private companies managing rural water facilities in more remote areas, where the population shifts to rainwater when available. Cross-subsidization of water supply services for service delivery in isolated areas and less developed regions may have to be considered. The findings indicate that the contracting out by municipalities of rural water facilities to private companies is not a solution for all rural communities, at least in the medium term.

7 Lack of clarity on the integration of maintenance funds for rural water supply into the public finance management of municipalities

The transfer of responsibility for rural water supply from the community to the municipality level is an integral part of Benin's devolution strategy. Accordingly, municipalities' responsibility for water supply is only one facet of a whole range of responsibilities for public services in general. Against this background, the financial strategy for maintaining water supply cannot be developed in isolation anymore, but has to be integrated into a system of public financial management at the municipality level, at least in the medium term. Therefore, it is questionable whether ring-fencing funds to save up for water maintenance and replacement, which was advisable for water user associations in the past, is still an adequate strategy for municipalities, because separate pots for every service inevitably leads to inefficiencies in liquidity reserves and financial planning.

[7] For an overview of evidence see http://library.wur.nl/WebQuery/wurpubs/lang/120667

1

Background and methodology

1.1 Purpose of the evaluation

This report provides the results of an impact evaluation of drinking water supply and sanitation (WSS) programmes in rural Benin which were supported by Germany and the Netherlands, among others. The evaluation has been undertaken jointly by the Evaluation Departments of the Netherlands Ministry of Foreign Affairs and the German Ministry of Economic Cooperation and Development, the latter in cooperation with the evaluation unit of KfW Entwicklungsbank, and in consultation with Beninese authorities and partner organisations, particularly the DG Eau (Ministère des Mines, de l'Energie et de l'Eau) and the DHAB (Ministère de la Santé), the Netherlands Embassy and the German Development Cooperation in Benin.

This study, as evaluations usually do, serves a dual purpose: on the one hand it sets out to provide evidence on what has been achieved for the purpose of accountability to those who provided resources in support of the programmes, e.g. the taxpayers in donor countries; on the other hand the evidence is supposed to serve as a source for learning lessons that will be useful for WSS policy development in the future.

For the Policy and Operations Evaluation Department (IOB) of the Dutch Ministry of Foreign Affairs this evaluation belongs to a series of impact evaluations which are undertaken as part of an evaluation of Dutch WSS development policy that informs the Dutch parliament.

The programmes of the Beninese rural WSS sector were chosen for an impact evaluation for the following reasons:

- In the first place, the programmes have received substantial support from both Germany and the Netherlands. German development cooperation, which has been active in the WSS sector of Benin since the late 1960s, provided support for investments in Beninese WSS of about EUR 8 million p.a. during the last years, complemented by technical assistance (GIZ–DED) of about an additional EUR 2.5 million per year. These figures include the support for urban water supply via SONEB (Société Nationale des Eaux du Bénin); a little less than half of the average annual amount supports rural WSS. Dutch development assistance has supported the WSS sector of Benin since 2003. The support is currently channelled through the Programme Pluriannuel d'appui au secteur de l'Eau et de l'Assainissement (PPEA), which runs from 2007 to 2012. The support that has been realised up to 2011 amounts to EUR 33.3 million, of which approximately 70% has gone to rural WSS programmes.

- Secondly, the design of the current rural programme seemed well suited to an evaluation producing rigorous (statistical) evidence on impacts. Dutch and German evaluation departments have invested strongly during the last years in producing such hard evidence on development effectiveness. In line with this, the application of statistical methods to measure impact is a common feature of all the impact evaluations which belong to the Dutch WSS evaluation series mentioned above.

- Thirdly, although rigorous evidence on rural WSS impact has been generated more frequently during the last years, the studies were usually focused on single projects financed by a single donor. Thus, evaluating the impact of a programme covering all the rural areas of a country and that is supported by several donors is still some kind of a novelty. It seems natural as well that such a study is undertaken as the joint endeavour of several contributors to the programme, as it would be impossible in this case to follow the single inputs.

- At last, precisely because it is an impact study not of a single project but of a countrywide programme, lessons to be learned should be of special significance for the future Beninese rural WSS strategy. This can be expected all the more as the impact study is complemented by an analysis of the institutional context promising to deliver valuable insights into the sustainability of results. These should be of special importance not only for the ongoing process of institutionally integrating the rural WSS sector into the Beninese decentralization strategy, but also for the WSS strategy in other countries with similar contexts.

The rest of this introductory chapter is organized as follows. The theory of change underlying donor supported WSS programmes is described in Section 1.2. Section 1.3 provides some of the existing empirical evidence on WSS impacts. Section 1.4 lists the evaluation questions and gives an overview of the three main chapters of the report. Section 1.5 describes the design and methodology of the impact evaluation.

1.2 Theory of change underlying WSS programmes

The supported WSS programmes aim to contribute to the target – subsumed under the 7th Millennium Development Goal (MDG) of ensuring environmental sustainability – to 'reduce by half the proportion of people without sustainable access to safe drinking water and basic sanitation'. The ultimate purpose of support to WSS facilities goes, however, beyond access. It is meant to improve the living conditions of the population in general and in particular its health.

This study distinguishes the following intended effects of water and sanitation programmes: increased access to and use of improved water sources[8]; increased quantity and improved quality of water provided and consumed; reduction in time spent on water collection, especially for female household members; increased access and use of improved sanitation facilities[9]; increased hygiene behaviour; decrease of water-induced diseases, especially among children, and the sustainability of the interventions. The theory of change, which links the supported programmes to the desired effects, differs between these categories. Some of the most complex mechanisms are involved in water-related health outcomes, particularly diarrhoea morbidity. For these reasons health improvements are discussed next in some detail as an illustration of the issues involved. Understanding the complexities in the causal health chain may result in improvements in the design of WSS programmes. It is noted, however, that programmes may also be justified in other terms, such as economically in case time gains are considerable, or socially if latrines provide privacy, particularly to women.

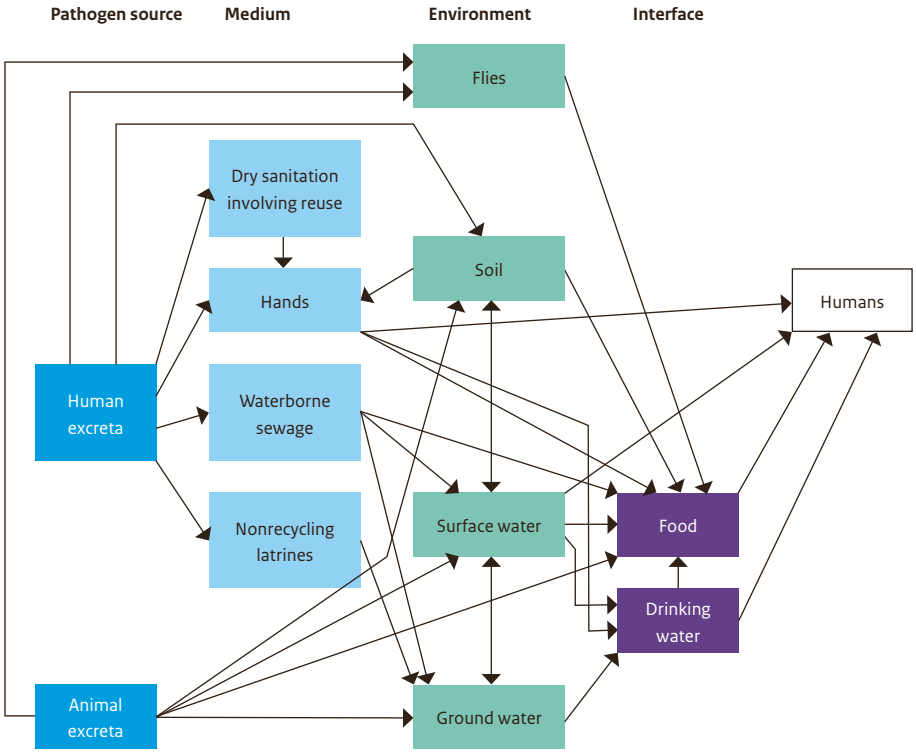
Recent estimates of the World Health Organization (WHO) ascribe about 10% of the global disease burden to waterborne diseases; and in a low-income developing country such as Benin, the situation is obviously worse than average. Almost 20% of all deaths and more than 20% of the disease burden (measured in DALYs – Disability-Adjusted Life Years) are estimated to be due to waterborne diseases in Benin, the problem being more pronounced for children (Prüss-Üstün *et al.*, 2008).

Transmission channels of waterborne 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.

[8] The definition of improved water sources and sanitation facilities used are the WHO-UNICEF definitions for the Joint Monitoring of the MDG targets (WHO-UNICEF, 2010). Definition improved water sources: sources that by nature of their construction or through active intervention, are protected from outside contamination, particularly faecal matter. These include piped water on premises; public taps or standpipes, tube wells or boreholes, protected dug wells, protected springs and rainwater collection.

[9] Definition improved sanitation facilities: facilities that ensure hygienic separation of human excreta from human contact. These include: flush or pour-flush toilet/latrine connected to piped sewer system; septic tank, pit latrine; Ventilated improved pit (VIP) latrine; pit latrine with slab, composting toilet.

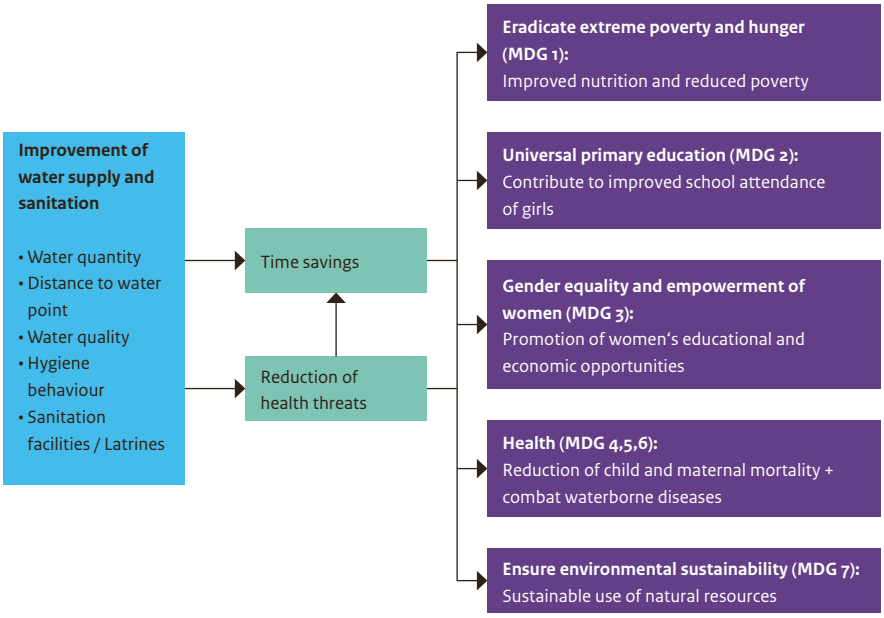
Figure 1: *Transmission pathways of faecal-oral diseases*



Adapted from Prüss et al, 2002
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. The interventions thereby contribute to a range of MDGs, as outlined below. Time savings resulting from closer proximity to water points, better availability in terms of quantity and possibly reduced queuing time are other impact channels. The reduction of health threats further contributes to time savings as less time needs to be spent preventing illness or caring for sick family members. Depending on how these time savings are used, they can contribute to achieving a range of MDGs. The impact assessment in Chapter 3 will test hypotheses with regard to the MDG dimensions health, education, and gender, as well as the assumption about time savings.

Figure 2: *Impact dimensions of improvements in the rural water and sanitation sector*



Source : KfW Entwicklungsbank

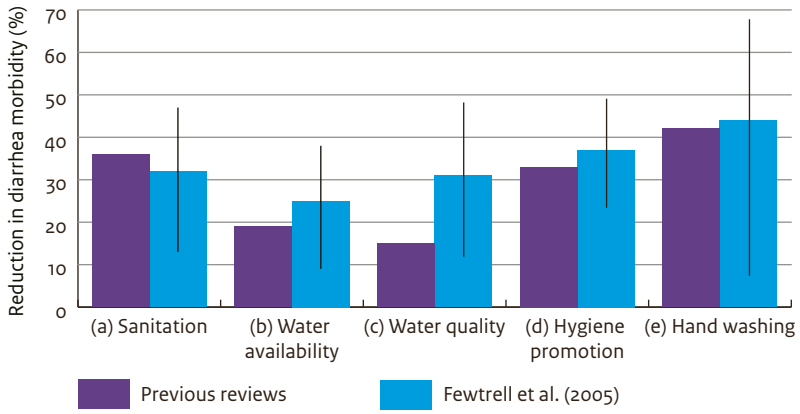
1.3 Existing empirical evidence

Evidence on the effectiveness of WSS programmes in achieving the multiple goals outlined in the impact chain has become more numerous during the last few years although the knowledge is still far from complete. The area that has probably been researched most thoroughly is the effect of WSS interventions on health, especially on reducing diarrhoea morbidity. Results of existing studies have been summarized 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 3 and illustrates that even though water supply (column b) has less 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 3 also shows 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 visualized by the vertical lines[10] in Figure 3, while bars show study averages in diarrhoea reduction). Interestingly, Fewtrell *et al.* (2005) as well as

[10] 95% confidence intervals

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. In the remainder of the report the term sanitation refers to both the (promotion of) building of latrines and to hygiene promotion (in particular hand-washing, the covering of water, the treatment of drinking water, the safe disposal of children's excrement, safe water and waste disposal).

Figure 3: *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 WSS interventions are even wider. 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).

Adding to the open questions on the impacts of WSS interventions, some researchers (Zwane and Kremer, 2007; Waddington and Snilstveit 2009) have criticized 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. As such this study is intended to fill a gap in the evidence on various impacts of WSS interventions.

1.4 Evaluation questions

The 28 evaluation questions that the study has been set out to answer are listed in Box 1 below. The questions deviate to some extent from the questions in the original Terms of Reference (Annex 1) in order to capture the questions that have actually been addressed by the study.

The questions in the original Terms of Reference on institutional analysis have been focused on institutional factors affecting the sustainability of interventions and beneficial impact. The particular questions have been adjusted and are captured under the heading 'sustainability assessment' in the list of questions below.

Box 1: *Evaluation questions*

Context and programmes

1. What have been key aspects of the problem and context of the supported Benin rural water supply and sanitation programmes?
2. How has the national institutional and policy context for rural water supply and sanitation evolved?
3. What programmes have been supported and what support have donor parties, in particular German and Dutch development cooperation, provided to the rural water supply and sanitation programmes?
4. Have rural water supply and basic sanitation infrastructure (latrines) output targets been realised?

Quantitative impact estimates

5. What was the water supply infrastructure in the localities before the interventions? What additional water supply infrastructure has been realised over the study period of one year?
6. Are there differences between localities regarding their probability of having access to an improved water source?
7. What was the sanitation infrastructure in the localities before the interventions? What additional sanitation infrastructure has been realised over the study period? Are there differences between socio-economic groups regarding their probability of having access to a sanitation intervention?
8. What has been the change in the proportion of the population using an improved water source? Are there differences across socio-economic groups with regard to water use?
9. Is the newly installed water source also used during the rainy season? Is there a reduction in the use of traditional and unsafe sources?
10. What has been the change in the quantity of water consumed? Are there differences across socio-economic groups with regard to the quantity of water consumed?

11. What has been the change in the quality of water at source and at point of use?
12. Is the impact of water enhanced by sanitation interventions and hygiene education?
13. Are there any seasonal differences in the impact of interventions on water quantity and quality?
14. What has been the change in the distance and time used for the collection of water?
15. Who collects water and who benefits most from time savings? Can an increase in school enrolment and/or attendance be observed and has saved time been used for more economic activities?
16. What has been the change in the access to and use of an improved sanitation facility for the population? Are there differences across socio-economic groups in terms of use?
17. What are the hygiene practices of the rural population? What has been the change in hygiene practices?
18. Have there been positive or negative unintended effects?
19. What have been the effects of water supply on the water related disease incidence of the rural population? Are the effects enhanced by sanitation and hygiene interventions?
20. What have been the effects on the number of days sick for the population? Has there been a reduction of health costs for the population?
21. What is the investment structure of water and sanitation service delivery?
22. What is the fee structure of service delivery and what is its potential for maintenance and/or cost recovery of service delivery?
23. What is the impact of a newly installed water point on water fees and are water fees a problem to the budget of the households targeted?

Sustainability assessment

24. Have existing hand and foot pumps and small piped systems been functioning over a long period of time?
25. Are the rural water supply and sanitation strategy, institutional structures and roles clear, applied and accepted?
26. Do the relevant institutions have the capacity for sustaining water supply infrastructure and services for water supply and hygiene and sanitation promotion in the long term?
27. Are costs recovered and are adequate financial arrangements for sustaining interventions made?
28. Are there other factors that affect sustainability not captured under question 24 to 27?

The questions are organised into three groups and define the three parts (chapters) of the study.

Chapter 2: Context description

The first part of the study addresses evaluation questions 1 to 4; it is concerned with establishing the facts around the identified problem, context, programme history, key inputs and outputs. It is qualitative in nature and sets the scene for the study. In order to better understand the national context in which the water and sanitation sector operates, a review of relevant documentation is presented (see list of references in Annex 4). Knowledge of the national context is essential as a reference for the subsequent impact and sustainability analyses. The institutional and policy setting is largely described based on the reviewed documents and as it is expected to work by design. Chapter 2 further presents national-level information on achievement of water supply and sanitation infrastructure targets reported by the concerned authorities.

Chapter 3: Quantitative impact estimates

The second part contains the quantitative impact estimates of the WSS interventions, including a description of the data and methodology. Here questions 5 to 23 are addressed. For the purposes of this study, impact evaluation is defined as the systematic identification of the effects of rural WSS interventions in Benin, supported by German and Dutch development cooperation. The main question is whether these interventions had an effect – positive or negative, intended or not – on the variables of interest for the households affected. The approach chosen for the impact evaluation is quantitative, relying on surveys of households and localities. In any impact evaluation a key question is to what extent observed effects can be attributed to interventions (the net effect or impact). This requires careful construction of a 'counterfactual', i.e. an estimate of how the affected households would have fared without the intervention. To this end, a quasi-experimental evaluation design (detailed in Section 1.5 and Section 3.1) was chosen.

Chapter 4: Sustainability assessment

Finally, the third group is aimed at providing a qualitative assessment of the sustainability of interventions and beneficial impact and addresses questions 24 to 28. Sustainability is defined as the (probability of) continuation of interventions and related beneficial impact after development assistance has been completed. This is of major concern to all stakeholders. The assessment addresses institutional factors, linked as they are to the fundamental quality of society's governance and politics, as well as relevant technical, economic and environmental determinants of sustainability.

1.5 Methodology

Quantitative impact evaluation: design, methodology and data collection

To identify whether there was change in the outcomes (evaluation questions 5 to 23) and whether this change can be attributed to the supported WSS interventions, the evaluation engaged in extensive information and data gathering as well as data-analysis according to state-of-the-art empirical methods. The evaluation provides information which meets the standard of a 'rigorous impact evaluation', defined by a comparison

between what actually happened and what would have happened in the absence of the intervention (White, 2006, 3) as its vital element. It is the construction of a valid counterfactual which allows the causal link to be established. An actual 'with and without-comparison' is impossible, because the same people can only either have been exposed to the intervention (with) or not have been exposed to the intervention (without). Therefore, the with-without comparison will always be a counterfactual with data collected from a control group which was not exposed to the intervention, but which is otherwise as comparable as possible to the intervention group, by sample design and/or by controlling for all differences between the control group and the intervention group in an econometric analysis.

Although the supported programmes have operated since the 1990s and will run until at least 2015, for methodological as well as for practical reasons, the quantitative impact evaluation covers only the period 2008-2010. The evaluation team conducted baseline and follow-up surveys of a sample of localities in rural Benin in order to analyse changes over time. The surveys were conducted both in localities where water and sanitation programmes were implemented during 2009 and in localities without such programmes. The team relied on a so-called 'phase-in' or 'pipeline' control sample, which is made up of localities that would take part in the programme at a later stage. The fact that these localities are very similar to the intervention group but have not received their water and sanitation interventions yet makes them an almost ideal control group. The employed 'double difference' approach (before/after, with/without – section 3.1 for details) allows for a more solid attribution of impacts compared to studies that rely on a single (with/without) cross-section survey.

The baseline survey was completed in 2009; the follow-up survey in 2010. The *départements* selected for the surveys were Mono and Couffo in the south, Collines in the centre and Borgou in the north-east, although Borgou unfortunately had to be dropped for the follow-up survey. The choice of *départements* was based on the following criteria: a) covering areas that are supported by different donors; b) infrastructure planning data; and c) geographical and ecological variation. Although the choice of *départements* does provide a degree of spatial heterogeneity, it is not nationally representative. For a fuller account of the sampling and methodology see Chapter 3.

A limitation of the quantitative impact evaluation is the relatively short time span that is considered. The baseline data were collected in February 2009 and the follow-up survey took place in February 2010. Between these two surveys, the new water points were taken into use. It is likely that a short time span between intervention and impact measurement means that for some variables the final effect is not yet visible; that is, the new equilibrium' has not yet been reached. For instance, it may well be the case that it takes more than a few months to settle into a new time-use pattern, especially when starting a business or some other form of market participation which involves risk or search behaviour. However, for other variables such as source choice and water quantity and quality the effects are likely to be visible immediately. The main health effects associated with water consumption should also be visible in the very short term: diarrhoea and vomiting resulting from contaminated

water are generally observed in the few days after consumption. In general, it is therefore fair to say that the impact estimates represent short-term effects. How these estimates relate to medium- or long-term effects depends on the variable and is difficult to say. One would expect that the impact on water quantity, time allocation and productive activities is viewed as a lower bound estimate of the medium-term effect, whereas the short-term effect of water source choice, quality and health may be higher than the medium-term effect presented (e.g. in case of maintenance problems).

Sustainability assessment

Evaluation questions 24 to 28 have been addressed through review of documentation, analysis of answers to relevant questions included in the household and locality surveys; focus group discussions of groups of women and men in a selection of 30 communities; and interviews with informants of key institutional actors at the community, municipality, *départemental* and central levels. The sites selected for the focus group discussions were localities with management problems according to the baseline survey (Nouatin and Moumouni, 2009). The focus group discussions were followed by a 16-day field investigation in all four *départements*. Interviews took place with a range of actors at the level of communities and consumers; that is users of small piped systems, hand pumps or foot pumps, local management committees, water facility operators, repair technicians and private sector managers; as well as with councillors and concerned government and Social Intermediation (ImS) NGO staff in ten local governments areas. Complementary interviews were held at the *départemental* and central levels. The list of interviews is attached as Annex 2. The main field mission for the sustainability analysis took place in October 2009. On the basis of information received thereafter, the analysis was updated accordingly.

2

Context for rural water supply and sanitation in Benin

2.1 Introduction

This chapter provides answers to the evaluation questions on context and water supply and sanitation programmes. The chapter starts with a brief introduction to the historical, political, geographical and socio-economic characteristics of Benin. It continues with the institutional and policy framework governing rural drinking water supply, hygiene and sanitation in Benin. As this framework has undergone some profound changes in the past years, a major part of this chapter is devoted to these changes. They include most notably the emergence of the first national water supply and sanitation (WSS) strategy (1992-2005) and the revisions that led to the second strategy (2005-2015), which shifted responsibility for rural water supply from user groups in local communities to municipalities. The chapter then turns to the support of donors for the rural WSS subsector, with special attention given to Germany and the Netherlands. The final section reports on recent target realisation for rural water points and basic sanitation as documented by the Beninese authorities. Each section starts with the concerned evaluation question and a brief answer, followed by more detailed information.

2.2 Country context

Evaluation question 1: *What have been key aspects of the problem and context of the supported Benin rural water supply and sanitation programmes?*

Benin is characterized by a relatively high incidence of waterborne diseases, as well as poor access to safe water and sanitation facilities. Rural areas are particularly affected by this. The present impact evaluation is relevant in order to better understand whether and how the installation of improved water sources or sanitation facilities, as well as hygiene campaigns, can contribute to lowering the disease burden among rural communities. Another aspect of the problem is the natural environment, which has a major influence on rural water supply, be it through the availability of groundwater or the variation in rainfall. The incidence of rainfall is also one example of the apparent 'slope' in the country from the rainy south to the drier north. The impact evaluation takes account of this variation by collecting data both in the dry and in the rainy season. Regional disparities between north and south are also found in population density, the incidence of poverty and ethnic fragmentation. The chosen départements for the evaluation therefore not only reflect areas of activity by the involved donors, but more importantly they cover a diverse range of geographic, demographic and socio-economic settings. At the political level, rural water and sanitation has been affected by the drive for decentralization, but the municipalities now in charge of ensuring their provision still struggle to raise the necessary funds. And last but not least, rural water supply affects the gender equality balance, since girls and women are predominantly in charge of it and potentially benefit most.

History

The country of Benin, located in West Africa and formerly named Dahomey, does not form a natural unity, e.g. according to natural geographical borders or a long-standing common cultural background. Like many other countries in sub-Saharan Africa, Benin rather owes its borders to its colonial past. After years of rivalry between the colonial powers regarding

the control of this area, Dahomey finally became a French colony in 1902, for the first time forming a political unity consisting of the rather differential areas in the northern part of Benin on the one hand and in the south on the other. The colony of Dahomey achieved its independence in 1960 leading the country into a decade of extreme political instability. A series of military coups took place until the coup in 1972 brought Maj. Mathieu Kérékou to power and a 'Marxist-Leninist' state was established. In 1975, President Kérékou proclaimed the name of Dahomey to be changed into 'the People's Republic of Benin'.

Although opposing forces to the ruling regime appeared now and again during the following years, it was not until the end of the 1980s that Benin experienced a severe political crisis which led to a 'national conference' in 1990. The discussions resulted in an overhaul of the political foundation of the country, including a new constitution. Benin became a multiparty democracy with a presidential system.

Political system

The Beninese political system preserved the characteristics of its multiparty presidential system of 1990 up to the present. Within the general government framework, some important changes of responsibilities have occurred. The first democratically elected government decided to initiate territorial reforms and introduce devolution, which does not only transfer administrative responsibilities, but also political power and fiscal resources to the newly created local government bodies. Via this reform, a more participatory management of local affairs was institutionalized. Seventy-seven new municipalities were created based on former sub-prefectures and urban districts. Other sub-national levels of government are six regions and twelve *départements*, which are both administrative entities.

The division of power and responsibilities between the different levels of government is laid out in the Constitution of 1990 and the laws on decentralization of 1999. However, it was not before December 2002, that the first municipal elections actually took place, with local governments becoming operational in 2003. The second municipal elections were held in 2008. Shedding some first light on the gender parity balance in Benin, the presence of women in these decision-making bodies is low, standing at 4.6% in 2008.[11] The low number of elected women is explained by party politics, the cost of campaigning and socio-cultural constraints (Carlos and Akofa Asare-Kokou, 2004).

Municipalities have autonomy and are governed by an elected council, councillors being elected by universal suffrage, generally via political party lists. Elected councillors choose a mayor amongst themselves. The mayor and the council run the local government administration and are in command of the budget. The administration of decentralised services and agencies is headed by a prefect nominated by the central government. The

[11] http://www.lanouvelletribune.info/20080620992/politique/apres-les-resultats-des-elections-municipales-et-communales.html

prefect is also in charge of supervising municipalities and has to ensure these entities act within the law.

As is characteristic of many decentralization reforms in sub-Saharan Africa, fiscal decentralization in Benin is lagging behind the transfer of responsibilities. Fiscal decentralization started only recently; budgets available to municipalities are low, and barely enough to cover recurrent operational costs. Available resources for investments in local infrastructure of public services are extremely limited in most municipalities. Generally, municipalities may only pay a small percentage of investment costs while ministries, special programmes and/or projects pay for the bulk. Some municipalities benefit from the *coopération décentralisée* or twinning, such as in Collines. The Fonds d'appui au développement des communes (FADeC), a multi-sector communal infrastructural development fund, was set up in 2008 by the government to transfer funds from central to local government. Standardized procedures for resource allocation and transfer authorization are now in place, and verification criteria have been set for monitoring resource use.

Decentralization reforms as a whole form an important backbone of the institutional framework of the WSS sector nowadays. Although FADeC contains a component for WSS, it has not had a notable influence on the results of the impact evaluation, as the programme is just starting to become an important resource channel for municipalities.

Demography and society

Benin covers an area of 112,600 km². The geographical layout of the country is narrow, having a coastline of 120 km in the south, while the length from the Atlantic Ocean to the northern borders with Burkina Faso measures about 650 km. The four *départements* selected for the impact study – Mono, Couffo, Collines and Borgou – are suited to capture the geographical diversity of the country. Mono and Couffo are located in the south with the Mono department bordering the sea, Collines forms the southern centre of the country, and Borgou, although being situated just north of Collines, represents the features of northern Benin (see Figure 4).

The total population of Benin in 2008 was estimated at 8.6 million people[12], 60% of whom[13] live in rural areas. About 1.2 million people live in one of the three major cities (Cotonou, Porto Novo, and Parakou)[14] and the remaining 2.4 million in what are called semi-urban areas. Average population growth is 3%, being about 4% in urban areas and 2.3% in rural areas. Urbanization and population density is highest in the southern part of the country and lowest in the north. Population density varies significantly between

[12] http://data.un.org/CountryProfile.aspx?crName=BENIN The total population according to the census of 2002 was 6,769,914 people.

[13] Rural population share for 2007, http://data.un.org/CountryProfile.aspx?crName=Benin

[14] Agglomerations larger than 2,000 inhabitants are semi-rural and classified as urban areas when having over 45,000 people.

the selected *départements*, amounting to 231 pp/km² in Mono, 103 pp/km² in Couffo, 40 pp/km² in Collines and 29 pp/km² in Borgou (2003 projections by INSAE, 2008).

Benin's ethnic fragmentation is rather high with over 40 different ethnic groups. The largest groups are respectively the Fon, Adja, Yoruba and Bariba. Although the official language is French, many local languages are also spoken. Ethnic fragmentation goes along with diversity in religion. According to the 2002 census, 43% of the population of Benin were Christian (mostly living in the south), 24% were Muslim (mostly in the north) and 23% practised traditional local religions, mostly voodoo (coastal areas). The kingdoms in Benin lost most of their formal powers during the colonial time following the destruction of their palaces, but they continue to have influence at the local level.

Matching the missing gender balance in political life, a gendered division of labour and a gender bias in access to resources and capacity building are still present in Benin. Fewer women than men have been to school. Two-thirds of women have not received any formal education and the level of literacy is also low (28% for women compared to 55% for men).

Natural environment

Disparities between the north and the south relevant for this evaluation can be found regarding the natural environment as well. Total annual rainfall in Benin averages around 1400 millimetres in the south, but only somewhat more than half of that (800 millimetres) in the north. The southern zone has two rainy seasons while the north has only one. Groundwater levels are being recharged for approximately six months in the south and three months in the north, when rainfall exceeds evaporation. Accordingly, groundwater levels in the north are rather sensitive to changes in rainfall patterns (Barthel *et al.*, 2009).

The geology of Benin is largely composed of Precambrian rocks. Sedimentary sequences are found in the coastal basin and in parts of the north. Accessibility of groundwater varies from a relatively shallow depth within reach of hand-dug wells up to as deep as 60 metres (FAO, 2005; Silliman *et al.*, 2007). In some parts of the country, it is difficult to find suitable groundwater sources. In the northern part of the country, the success rate for boreholes is estimated at a low 60% (Hadonou and Lambrecht, 2009). Cities like Parakou (Borgou) and Savé (Collines) increasingly have to rely on surface water reservoirs for their drinking water supply. Constraints for accessing groundwater in the densely populated coastal areas are salt-water infiltration and a lack of 'firm soil'.

Furthermore, water quality in Benin can be affected by high levels of fluoride, uranium and nitrate, a problem found particularly in Collines (Silliman *et al.*, 2007).

Economy and poverty

Benin belongs to the poorest countries in the world, reflected in its Human Development Index of 0,435 (2010) which ranks Benin as 137 of 194 countries.[15]

The economy is still largely dominated by agriculture, the production typically being rainfed. The agricultural sector employs 60% of the workforce and generates about one third of gross domestic product (GDP). In 2008, GDP per capita was USD1332.[16] Real GDP growth was 2.7% in 2009, following growth rates of over 4% and over 5% in 2007 and 2008 respectively. The economy is strongly influenced by the performance of the cotton sector, the port of Cotonou and trade flows with Nigeria.

The incidence of monetary poverty increased from 28.5% in 2002 to 33.3% in 2007 with the *départemental* values showing a slope from the north to the south: Borgou has the highest percentage of rural monetary poverty (46.4%), Mono has the lowest (27.7%). Non-monetary poverty, which is a composite index for living conditions that includes access to water, reduced slightly from 43.0% in 2002 to 41.1% in 2006 (République du Bénin, 2007). Surprisingly, non-monetary poverty is highest in Mono (54.7%) and lowest in Collines (31.2%) (INSAE, 2009).

Health and nutrition

Living conditions in Benin are also characterized by adverse circumstances concerning public health and nutrition. The most important diseases in Benin are primarily malaria, tuberculosis, waterborne diseases and diseases resulting from poor sanitation, such as diarrhoea and dysentery. Malaria, respiratory infections and diarrhoea account for most diseases among young children. Overall, children's health, maternal health and neonatal health show limited progress, especially in the poorest households. The reported maternal mortality rate is 400 per 100,000 live births.[17] Infant mortality (under one year old) is high and stands at 76 deaths per 1000 live births in 2008. The Demographic and Health Survey (DHS) of 2006 found child mortality (probability of not reaching the age of five years) to stand at 137 per 1000 children nationally. The spread among the *départements* chosen for the impact study ranges from Mono (101/1000) to Couffo (122/1000), Borgou (125/1000) and Collines (141/1000). The DHS (2006) also shows that national immunization rates for young children are decreasing (from 59% in 2001 to 47% in 2006) and child nutrition has worsened in recent years. About one-third of the children suffer from malnutrition. Many children (65%) are (severely) stunted. Based on the 2006 Demographic and Health Survey, 1.2% of the adult population is estimated to be HIV positive. More than 85% of the population live within five km of a health centre, but availability of equipment and drugs is poor and health workers may not be available.

15 http://hdr.undp.org/en/data/trends/, accessed 07-01-2011.

16 http://data.worldbank.org/indicator/NY.GDP.PCAP.CD accessed 21-09-2010; http://ddp-ext.worldbank.org/ext/DDPQQ/report.do?method=showReport accessed 16-11-2010

17 http://www.unicef.org/infobycountry/benin_statistics.html accessed 27-3-2010

Around one fifth of the death and disease burden in Benin is related to water, sanitation and hygiene. This is a large proportion even by African standards, higher than those in neighbouring Togo and Nigeria and about the same as in Burkina Faso (Prüss-Üstün *et al.* 2008). Among the various illnesses responsible, diarrhoeal diseases are by far the most important ones. As in most developing countries, children bear a disproportionate share of this affliction. The DHS (2006) shows that 9% of children under the age of five had been suffering from diarrhoea in the two weeks before the survey. By *département*, the incidence of child diarrhoea was 6.0% in Couffo, 6.7% in Mono, 11.4% in Borgou and 13.8% in Collines. For the country as a whole, the diarrhoea incidence is slightly higher in rural (9.7%) than in urban (7.8%) areas.

Access to safe water and sanitation in rural areas

The above-mentioned disease burden is arguably linked to the availability, or rather lack of, safe water and sanitation facilities, especially in rural areas. According to WHO-UNICEF, 69% of the rural population had access to an improved water source in 2008, while only 4% were using an improved sanitation facility. Looking at the neighbouring countries in the region, the situation in rural Benin is relatively good concerning rural access to safe water, but similar to the worst performers with regards to sanitation: for 2008, Burkina Faso registered rural access to improved water of 72% of the population; access to sanitation was 6%. These figures are only marginally below those for Ghana. In Togo the population shares were only 47% and 3% for improved water and sanitation respectively. In Nigeria to the east, rural access rates were 42% and 28% respectively, the latter being unusually high for the region. In northern Niger, the shares stood at 39% and 4%.

2.3 National policy and strategy on drinking water supply, hygiene and sanitation

Evaluation question 2: *How has the national institutional and policy context for rural water supply and sanitation evolved?*

The most important change relevant for this evaluation arguably is the revision of the national rural drinking water strategy in order to implement the new municipal responsibilities of the devolution strategy. Major changes brought about by the revised strategy were the shift of management responsibilities and ownership for local water points from local water users' associations to municipalities as well as a delegation of formerly central governments' responsibilities to the municipality level. These changes have some influence on performance and sustainability of interventions and potential impacts. These points will be taken up in the following chapters, most prominently in Chapter 4 on sustainability.

La Direction Générale de l'Eau (DG Eau)

Emergence of a public drinking water service for rural areas

For decades, the provision of drinking water has been a public service in Benin. Initially attached to the Public Works Office[18], the service became known as the Direction de l'Hydraulique (DH) in 1967.[19] The DH developed capacity to conduct studies, build infrastructure and oversee sub-contracted works. In 1992, the DH was placed in the then Ministry of Mines, Energy, and Water Engineering (MMEH)[20], which later became the Ministry of Energy and Water Engineering (MEE). In 2006, the DH became the Direction Générale de l'Eau (DG Eau) with the dual mandate of managing water as a resource (Integrated Water Resources Management) and supporting municipalities in the provision of drinking water in rural and semi-urban areas. The semi-public water company Société Nationale des Eaux du Bénin (SONEB) is responsible for providing drinking water in urban areas.[21] A code de l'Eau was approved in 1987. A proposal for the revision of this code was sent to parliament in 2005, and was approved in October 2010.

In contrast to some African regions rich in water resources, water supply in the rural areas of Benin has always been an important topic, as particularly during the dry season (safe) water becomes in short supply in the northern areas. In response to this scarcity and the poor quality of remaining surface water, the population traditionally used to dig large-diameter

[18] By Decree N° 63-08 PR/TP from 1963 onwards.
[19] With Decree N° 358 PR/MT.
[20] Under Decree N° 92-46 of March 1992.
[21] With respect to densely populated rural areas along the coast, an extension of the piped SONEB-network could be more cost effective as suitable groundwater is difficult to find.

wells that could reach the upper, weathered zones. The disadvantage of these unprotected wells is generally poor water quality. To tackle this problem, the installation of drilled boreholes equipped with manual pumps (FPMH) was pushed by the government as far back as the 1980s. As boreholes are sealed, the risk of water contamination with this technical solution is low. However, manual pumps require regular maintenance and repair work (Silliman *et al.*, 2007). Nevertheless, sealed boreholes with pumps have remained the most widespread technical option to provide for a safe water source up to the present, at least in sparsely populated rural areas. AEVs (Adduction d'Eau Villageoises, or small piped water supply systems) are a technically more elaborate option and have been established in rural areas with relatively high agglomerations of the population (at least 2000 people) since the 1990s. AEVs are deep wells with a high capacity that are equipped with submersible, electric pumps. A network of pipes supplies public taps where the water is sold.

The need to improve the water supply in rural Benin also found early recognition among the international community. In 1981, the United Nations instituted the International Drinking Water Supply and Sanitation Decade (IDWSSD). The first activity undertaken in Benin as part of the IDWSSD was an estimation of the need for water points in rural areas. The study concluded that 4,575 water points were required (each serving 500 people). An externally-funded programme was set up to install these boreholes. During the 1980s, government representatives, resource persons and donor agencies regularly met in international fora to assess progress. When the IDWSSD came to an end in 1990, it was concluded at international level that limited government capacity and poor local participation in the processes of installing, operating and managing amenities was jeopardizing the sustainability of the newly installed water points. Moreover, progress around sanitation and hygiene was limited as a result of lack of knowledge and minimal investment in this sub-sector (Langley, 2007).

First national strategy for drinking water in rural areas (1992-2005)

Policy makers in Benin shared the international concern about the limited sustainability of investments in drinking water amenities. In 1990, these policy makers set about to develop a national strategy for Benin to improve rural drinking water supply by investing in infrastructure, maintenance, and rehabilitation; and herewith improving the efficiency of operations and sustainability of investment. The policy was approved in 1992 (DH, 1992).[22] Donor agencies assisted the DH with formulating policy and procedures, clarifying roles and responsibilities, and building capacity for service delivery.

[22] This strategy is implemented within the legal framework of the constitution, administrative law, the water code and the decree regarding the organization of the MMEE. The water and public sanitation codes date back to before independence, and are currently being revised.

Borgou; protected well with handpump

Key elements of the first national sector strategy were for the DH (and thus later its successor DG Eau) to become a facilitator for and regulator of the sector, and not a constructor of water points. Decision-making on installation and maintenance of water points would be devolved to the *départemental* level and local water user associations would be engaged. Hygiene awareness was envisaged as an integral element of water development programmes. To improve the sustainability of investments, a community-based approach would be introduced to promote ownership and responsibility for the water points. A water point would only be installed following a request made by communities, which promoted demand-driven investments in the sector. Communities would contribute financially to the initial investment, donate a site, provide labour for construction, and help recover maintenance costs. Setting up a community-based management committee around the water point was planned to be part of a standard procedure, and special attention was paid to assist women in participating fully in these structures. So-called 'social intermediation' by external agents would be introduced to help communities to organize and assume responsibility, and to create the interface between users, committees and the DH.

A guiding principle in the first strategy was that *l'eau paie l'eau* (literally, 'water pays for water'), i.e. safe drinking water would no longer be free. The price of water should cover all recurrent costs of water production, services, monitoring, maintenance, and rehabilitation. The community-level water user committees were to collect payments for water and maintain the water point.

In an active pursuit of deconcentration and subsidiarity, the Water Authority is one of the few government agencies that set up services in every *département*. The next step was that

progressively more responsibilities and resources were transferred to the departmental level (Service eau or S-Eau), DH staff was spending more time in the field and contacts with communities became more regular. The process started in 1993 with support of the World Bank and Danida.[23] [24] In 1998, with the support of Danida, an annual operating budget was allocated which made the S-Eau financially more autonomous and increased its flexibility (Danida, 2004). The *départements* also became responsible for public procurement and handled community applications for water points.

Standardization of pumps and other technical norms were introduced to reduce the costs of constructing and maintaining installations. Only four types of pumps were allowed, in order to reduce problems with availability of spare parts and repair capacity. The setting up of a single national stock of pumps has helped in regulating the system even more (World Bank, 2004). Maintenance was to be facilitated by setting up a network of local repair shops and ensuring the availability of spare parts. Moreover, privatization was to be promoted for all activities related to the establishment of water facilities, such as technical studies, drilling, control of quality, supply of pumps and spare parts.

Second national rural drinking water strategy (2005-2015)

In the run-up to 2005, the first national strategy was revised to incorporate the responsibilities of the newly established municipalities and changes in public finance management, which characterized the devolution strategy. According to the law, the new municipalities are legally in charge of installing hydraulic pumps and ensuring the provision and distribution of drinking water. They have to maintain healthy and salubrious conditions when prospecting for and distributing drinking water, as well as a clean area around water catchment areas, boreholes, and wells. Municipalities are also responsible for overseeing the protection of water resources and water tables; they have to develop by-laws on individual waste water treatment (latrines, septic tanks, cesspools) and initiate measures to promote their use. These far-reaching responsibilities were adopted in the revised strategy of 2005, covering the period 2005-2015. The new division of responsibilities between the different levels of government, in particular the incorporation of the legal roles and extended responsibilities of municipalities brought about major changes for the local communities. Municipalities are now in charge of the management of water points, replacing communities in this role. Moreover, water points have become the property of local governments while before communities were at least acting as proprietor. These changes were effective at the time of the evaluation.

[23] At the time, the Ministry of Agriculture was the only other organization to have taken similar action, with the introduction of deconcentrated CARDERs (Regional centres for rural development). These subsequently became CeRPAs (regional centres for agricultural development).

[24] Order N° 25 MEMH/DC/C-CAB/DH of 21 December 1993, regarding the attributions, organisation and functioning of the Direction de l'Hydraulique.

The tasks of the central level (DG Eau) are to define the policies of the sector, ensure that procedures are managed transparently, guarantee standards for water quality and ensure the protection of water sources. The *départemental* water services (S-Eau) concentrate their efforts on lending support to municipalities; monitoring performance; and upholding regulations and standards for designing, undertaking and using installations. Municipalities need to be able to oversee the installation and maintenance of the infrastructure themselves, e.g. to select and monitor the specialist consultancy firms that will be responsible for preparing tender documents and for monitoring the commissioned companies. They can call upon the support of the DG Eau but need to organize the process themselves and have to make their own judgements. Municipalities have their own technical services, paid out of their own budget or via special project and programme funds allocated to municipalities. Other staff members have been assigned by central government. Staffing levels vary considerably across municipalities, partly reflecting availability of resources. Legislation on the position of municipality staff, that will determine whether they become civil servants of central government, civil servants of a specially created 'municipality force', or have a separate contract with municipalities, has been delayed.

Although the formal transfer of responsibilities from S-Eau to municipalities has been completed, its practical implementation is progressing slowly, such that at the time of the evaluation, S-Eau continued to play an important role in the construction of water points. The reasons for that are manifold, the most important ones certainly being the lack of know-how and resources at the local government level. Although plans for advisory support to municipalities had been developed at the regional level (prefecture), no funding was available for their implementation.

Another change brought about by the revised water strategy, which in its success is less dependent on municipalities' capabilities and funds, is the professionalization of management of AEVs and manual pumps. The revised strategy introduces measures to ensure that installations are transparently managed under municipal supervision by the private sector or a restructured water user committee (approved management plans, monitored contracts, and audited water accounts). The necessity of professionalizing the management of water facilities, in particular for AEVs, was emphasized during the annual sector review process. The main reason given for introducing professionalism, and thus abolishing community management, is to ensure sustainability of the investments. Contracting out management to professional private sector companies is to improve the quality and regularity of maintenance and a better management of proceeds from water payments. The latter will ensure that sufficient money is available for major repairs and replacement of infrastructure. In addition, more water taxes become available for the municipality. In 2006, the conditions for sustainable management of AEVs were discussed during a workshop and four management options were identified. Municipalities could decide to engage actively or fully delegate, and opt for working with a restructured water user committee, a private operator or a combination of both (Ambs, 2010). This change started in 2007 and was mid-way in 2010.

Small piped water supply system

In 2009, a revision process of the second national strategy for drinking water was initiated, partly to address some discrepancies with other laws. This revision may also be used to accommodate emerging practice. A significant recent change is the proposed shift from demand-led programming of new water points in response to a community request, towards the use of objectively established needs. Programming of water points is to be done by municipalities on the basis of objectively established needs. Municipalities are expected to allocate new water facilities based on already existing availability of water points in relation to population density and distance to be covered to reach the nearest water point. This new planning system aims to introduce a kind of minimal service level for access to safe water and contribute to more equitable access to water amenities. Communities with the lowest access to drinking water are supposed to be served first.

This change will be an overhaul of a long-standing approach, which was developed in the 1990s to improve the sustainability of water points. The old demand-led approach is reported to increasingly hinder access to safe water for all. More marginalized communities are found to be less able to put in a request and to mobilize the required resources. Necessary preconditions for this change in allocating water points are clear selection criteria, availability of up-to-date data at the *départemental* and communal level, and no undue influence of interest groups in the decision-making process. This planning system is in place in Collines and currently also introduced in the other departments.

While the second strategy is being put into practice, some elements have fallen short of expectations. This is further elaborated on in the Sustainability assessment in Chapter 4.

Hygiene and Basic Sanitation Directorate (DHAB)

Hygiene and sanitation policy and strategy

Hygiene and sanitation interventions are guided by the code d'hygiène publique, approved in 1987, the Programme national d'hygiène et d'assainissement de base (PNHAB) of 1995, and the Manuel de Promotion de l'hygiène et de l'assainissement de base (PHA). The PNHAB provides the basis of the national hygiene and sanitation action plan developed in 2003 for the period 2004-2008. The PNHAB is presently being reviewed to incorporate changes in the institutional context. Several donors are assisting the Hygiene and Basic Sanitation Directorate (DHAB) with the integration of hygiene and sanitation in the health sector programme.

The PNHAB sets out the responsibilities of the Ministry of Public Health for hygiene and sanitation. The DHAB in the Ministry of Health is in charge of sanitation and hygiene. DHAB has offices in ten of the 12 *départements*, with Mono and Couffo and Litoral and Atlantique having shared services. Hygiene assistants and technicians are based at the health centres and work with a network of volunteers who act as village contact persons (relais communautaires). Together they set priorities, as well as plan and implement promotion activities. Some villages organize monthly sanitation campaigns via the village head. Since 2010, some hygiene assistants have been based at the municipal office, which may give an extra impetus to the work of local governments on hygiene and sanitation.

Although formally municipalities have a significant role in hygiene and sanitation, they have not undertaken many activities yet.[25] The main activity is the financing of the chlorination of wells at the request of hygiene assistants, to make water safe for human consumption. The DHAB organizes chlorination of wells and larger water bodies that are used for drinking water in Mono and Couffo, and for private water production points. Water purification tablets are promoted via 'social marketing' by PSI (USAID), and also distributed by organizations such as UNICEF and NGOs via hygiene assistants.[26] The harmonization of approaches between the government and non-state actors is still incomplete as illustrated by differences of approach on the matter of the promotion of latrines. Although government policy is not to subsidize the construction of latrines, some NGOs do give such financial support.

With the aim of realizing synergies, rural drinking water supply programmes are expected to include activities to raise hygiene awareness, which requires coordination between the DG Eau and the DHAB. Hygiene assistants, and in some departments also the NGOs for intermediation sociale (ImS), should monitor hygiene promotion, but in practice this is not systematically done.

Finally, with respect to water quality, the Ministry in charge of water only checks water quality when the borehole is constructed. Thereafter, the responsibility for checking water quality lies with the Ministry of Health. This is not yet done systematically, but the required capacity was reportedly being built up. The DHAB expected to release its first report on water quality in 2010, although it has not been received yet by the evaluation team.

2.4 Support by donor agencies to water and sanitation programmes

Evaluation question 3: *What programmes have been supported and what support have donors, in particular German and Dutch development cooperation, provided to the rural water supply and sanitation programmes?*

The section gives a fairly comprehensive picture of donor support to rural water supply and sanitation programmes, in particular for the cases of Germany and the Netherlands. One must note that since donor activities are aligned with national strategies, it will generally not be possible in the impact evaluation to trace impacts back to individual donor contributions.

For several decades, donors have been contributing to the realisation and rehabilitation of infrastructure for drinking water in rural areas in Benin and have been providing support

[25] Particularly Section 3 (environment, hygiene and cleanliness) of Law N° 97-029 of 15 January 1999, regarding the organization of municipalities in the Republic of Benin. Chapter III of 'The competencies of the municipality' in Law N° 97-029 of 15 January, 1999 regarding the organization of municipalities in the Republic of Benin.

[26] Politicians also donate such tablets during campaigning (as happened in Mono). Moreover, consumers may add some chlorine (household bleach) to jars or to the water that is used for washing food.

to policy development, implementation and the building of capacities. In addition to Germany and the Netherlands, main donors have been multilateral banks, France and Denmark. In response to evaluation question 3, this section provides an overview of donor aid to the sector, with a focus on German and Dutch assistance. Initiatives towards coordination, harmonization and alignment among the various donors started in the 1990s. Donor coordination was organized via the PADEAR (Programme d'appui au développement du secteur de l'eau et de l'assainissement en milieu rural), which was set up in 1993 by the World Bank and Danida. PADEAR was developed to facilitate the implementation of the first national drinking water strategy by assisting the DH at national and sub-national level. Both financial support and technical assistance were made available. PADEAR started a pilot programme in two regions, Zou and Atlantique, to test the roll-out of the national strategy. In 1996, Germany joined PADEAR and funded work in Ouémé and Mono. The programme expanded in 1998 to Alibori and Borgou with Danida support. In 2001, Germany began supporting five municipalities of the Atacora *Département* and two municipalities of the Donga *Département*, again within the framework of PADEAR. Dutch support has been aligned to the national sector policies and harmonized with other donors from the beginning (i.e, from 2004), initially by linking to the PADEAR and the Programme d'Appui au Développement du secteur de l'Eau et de l'Assainissement (PADSEA) and currently through the Programme pluriannuel d'appui au secteur de l'eau et de l'assainissement (PPEA), that runs from 2007 to 2012.

Sector support programme

Government and donors work together in a technical sector working group for the water and sanitation sector, which is chaired by the DG Eau. The meetings are held regularly and attended by a range of government agencies, including the ministries in charge of public finance, decentralization, and public health. Government and donors assess annually the performance of the sector by monitoring the indicators of the objective-based programmes. Examples of indicators that have been set are the number of people served; the number of water points and latrines, as well as whether they are operational; the proportion of bidding contracts awarded at the regional level; progress with integrated water resource management; and several financial indicators. This annual review is a key event for assessing progress, learning lessons, and proposing change or corrective measures. Since 2005, the review has taken place under the auspices of the MEE and most donors active in the sector (multilateral, bilateral and non-governmental) participate.

The sector working group played an important role in developing pooled funding programmes, such as the 'initiative eau'. In 2003, considering that an estimated 50% of the people in semi-urban areas did not have access to a drinking water system, major donors proposed to jointly fund a specific programme for semi-urban centres, which is implemented in accordance with national budget execution procedures. This programme started in 2004 and targets 500 settlements that are not covered by SONEB's investment plan. These areas are to be provided with AEVs by 2015. The programme is expected to cover about 50% of the total number of equivalent water points needed to reach the MDGs (MDEF, 2006).

German support for water and sanitation

Benin is one of German development cooperation's oldest partner countries, with support for the water and sanitation sector as one of the priority areas. The first German-funded water supply systems were already implemented from the late 1960s onwards.[27] Later, support for water supply in rural areas was harmonized with partners and aligned with national strategies under PADEAR between 1996 and 2006, as explained in the preceding section.

The German Federal Ministry for Economic Cooperation and Development (BMZ) is in charge of Germany's development policy and cooperation, funding all bilateral technical and financial cooperation activities and coordinating between the various implementing organizations. Implementation is commissioned through GIZ (German Agency for International Cooperation, which in 2011 replaced the various German technical cooperation agencies, most importantly GTZ and DED) and KfW Entwicklungsbank. Since 2000, development projects and programmes in the water sector by all German implementing agencies have been coordinated under a joint framework, the Programme Eau Potable (PEP). This programme comprises German support to the Beninese water sector in 12 secondary cities and six *départements*, including project support in rural areas. Since 2007, German Financial Cooperation channels parts of its funds through a basket targeting the development of village water network systems (AEVs) for the construction of pumps and by co-financing SONEB's investment programmes (2009-2011).[28] German technical assistance has been provided to the *départemental* level and to DG Eau and SONEB offices at the national level. With about EUR 1.3 million per year of support given to the DG Eau alone, the majority of technical assistance has been for the benefit of rural areas.

A new strategy paper with priority areas for water and sanitation was adopted at the end of 2008. Priorities are upgrading management skills at both national and municipal level, and improving access to sanitation through infrastructure investment complemented by policy advice. Previously, sewage and sanitation (e.g. public latrines in schools and markets) played only a minor role in German cooperation, but they are now gaining in prominence. In addition, Germany is expanding its programme-based approaches. It cooperates with other donors on several basket funds to improve drinking water supplies in urban and rural environments.

In the past few years up to 2010, German support for investments and technical assistance in the water and sanitation sector in Benin averaged EUR 10.5 million annually. An exact allocation of financial cooperation funds between rural and urban areas is not possible due

[27] These projects were located at Porto Novo (1969), Abomey–Bohicon (1972) and Lokossa–Athième (1974).

[28] The German sector strategy for urban water supply was officially launched in July 2007 and prioritized improvement of water supply infrastructure, such as rehabilitation, extension and densification of pipes, as well as the construction of new pumping and treatment systems. Other goals are enhancing efficiency of regional offices that are serving piped systems in municipalities and a reform of the water tariff system that was finally implemented in 2009, improving the financial position of SONEB.

to basket funding which benefits both areas, but somewhat less than half are estimated to benefit rural parts. Following the phase-out of the Collines programme, funded by the French Development Cooperation (ADF) at the end of 2009, Germany is currently the largest donor in the sector besides the Netherlands.

Netherlands support for water and sanitation

Development support by the Netherlands to the Beninese Water and Sanitation sector started in 2004. The Dutch policy for development support for drinking water supply and sanitation is aimed at contributing to sustainable access for poor people who currently do not have access to safe drinking water and basic sanitation, targeting 50 million people worldwide by 2015. From the start, the support in Benin has been aligned to the national sector policies and harmonized with other donors, initially by linking to the PADEAR and the Programme d'Appui au Développement du secteur de l'Eau et de l'Assainissement (PADSEA), which includes the promotion of latrines and hygiene education. Between 2004 and 2007, three successive Water Programmes (Eau I, Eau II, and Eau III) were implemented.

The Programmes Eaux, or water programmes, were aligned with legislation, regulations and national procedures for sector policies on rural drinking water and sanitation, decentralization, deconcentration and public finance management. They were set up as pilot programmes to address bottlenecks around public finance management and decentralization that were delaying the implementation of the national rural drinking water strategy.[29] One of the issues is the transfer of funds to cover the municipalities' needs. The pilot approach was used to assist the Beninese government with developing and testing the reliability and robustness of new budgetary procedures, and resolve emerging bottlenecks. Another issue was to assist municipalities, S-Eau and the prefecture with their new mandates, in particular with respect to procurement. However, when comparing Eau I to Eau III, the focus shifted away from municipalities to the S-Eau to ensure that the output targets in terms of water points were met (Blankwaardt *et al.*, 2006; Hilhorst and Adjinacou, 2008).

Other donors acknowledged the strategic importance of working systematically through the public finance system, but did not want to endanger the establishment of water works by possible disbursement setbacks created by hurdles in financial procedures. These donors therefore supported the pilot by making earlier obtained applications for water points available, which meant that the water programmes were able to produce results within just two years.[30]

In 2006, following an external evaluation of the water programmes (Blankwaardt *et al.*, 2006), the government of Benin was invited to formulate a new multi-annual programme

[29] The PADEAR programme in Atacora and Donga also set up pilots on how best to support municipalities in managing the establishment of water points such as in priority setting, planning, tendering, contracting (Lambrecht, 2006)

[30] Normally, the full cycle for preparing this type of application with social intermediation takes an average of 18 months, and it is not possible to start works until the third year.

for donor support for the water and sanitation sector. This resulted in the Programme pluriannuel d'appui au secteur de l'eau et de l'assainissement (PPEA). The PPEA runs from 2007 to 2012 and is the channel for all Dutch support. The programme was reformulated in 2008 to incorporate the activities supported by Danida. As of 2010, Danida has become a silent partner in PPEA. PPEA has become the largest programme in the water and sanitation sector.

Box 2: *Components of the PPEA*

The aim of PPEA is to arrive at significant improvements in access to drinking water and sanitation related MDGs. The strategy is reinforcement of the programme approach and budgetary support, strengthening deconcentration and devolution, integrating gender issues and poverty reduction, and supporting integrated water resource management. The programme activities are organized in four components with the third component receiving the largest share of the available funding:

- Component 1 – Strengthening budget support for the drinking water and sanitation sector by improving public finance management procedures, and supporting deconcentration and devolution.
- Component 2 –Developing municipal responsibilities for water and sanitation, by assisting the progressive transfer of competencies and developing municipalities' capacities to manage drinking water and sanitation facilities
- Component 3 – Developing infrastructures for drinking water and sanitation systems in an equitable and sustainable manner
- Component 4 –Supporting the Integrated Water Resource Management (IWRM) process to guarantee the long-term availability of sufficient quality water to meet all users' needs

Differences in support provided

A relevant question for an impact evaluation is whether there are differences in strategies and interventions supported by donors that may explain findings on impact in the study. There are no differences in strategic objectives between the donors since all adhere to the national strategy on water. However, there are differences in support provided across *départements* and municipalities in terms of provided resources and the manner in which these were or are provided, including technical assistance. In 2006, for example, Germany supported six *départements*, and Danida five. In 2006, Danida transferred one *département*, Collines, to AFD. At the time of the impact evaluation in 2009–2010, German technical cooperation was besides departmental projects also active at the national level. Danida supported sanitation in Collines, while the rural water sector was supported by AFD, working together with other French organizations. In 2009, Danida also supported Borgou, which is now covered by the Netherlands-supported PPEA since 2010. NGOs also tend to focus their support geographically. PROTOS, for example, is mostly active in Mono and the Atacora.

Moreover, piloting of new policies started in selected *départements*. Examples are AFD–Antea activities in Collines on the programming of water facilities or the monitoring of private water production facilities started by GIZ. The latter is a recent development in some *départements* (Collines and Ouémé), where individuals construct small AEVs and sell the water. About 1500 such private water production points have been registered. DHAB has started to promote chlorination for these cases to ensure water safety.

With respect to hygiene and sanitation, there are differences in strategies, approaches and available resources between *départements*. Danida has supported the implementation of the hygiene and sanitation action plan since 2005 via PADSEA. In Collines, and elsewhere in Benin, Danida has assisted the development of comprehensive hygiene and sanitation action plans in selected municipalities. Approaches to hygiene in the terms of references for the NGO intermediation sociale also differ. Hygiene is included in *départements* supported by German technical cooperation, but not in the AFD-supported Collines. In Mono and Couffo, German technical cooperation is testing the development of local government sanitation plans. A number of other programmes and projects support hygiene and sanitation as well.

There are also differences in the rates of drinking water installations between funding sources, as shown by Table 1 below. According to the DG Eau, for both years 2007 and 2008, the overall number of water points constructed fell short of the number planned, but the execution rate improved from 72% to 81%. International donors as a group registered fairly decent execution of planned water points, but there is notable variation between individual donors. This information needs to be treated with care, however, because the figures were compiled by the DG Eau at the special request of the evaluation mission, and the table which was produced partly required the artificial transformation of project-based information into annual plans and execution rates.

Table 1: Rate of drinking water installations (2007-2008)

Source of funding	2007			2008		
	No. Planned	No. constructed	%	No. Planned	No. constructed	%
National Budget	269	236	88%	228	296	130%
International donors	1974	1404	71%	1670	1529	92%
Pot Commun 'Initiative Eau'	32	0	0%	418	46	11%
Total	**2275**	**1647***	**72%**	**2316**	**1871**	**81%**

* *including seven installations funded by the Loterie National du Bénin (LNB)*

Source : DG Eau

2.5 Realisation of sector targets

Evaluation question 4: *Have rural water supply and basic sanitation infrastructure (latrines) output targets been realised?*

Donor support is predominantly aligned to national strategies. The majority of donor funding is on-budget while a considerable part (PPEA, AfDB) is also channelled through the national treasury, even if the money is not provided as general or sectoral budget support. Accordingly, a meaningful assessment of target achievement seems to have to relate to national targets, the most obvious ones being the Beninese water and sanitation related MDGs. Although the disbursement rate of funds budgeted for the sector is low, even if picking up in the last years, the rural water sector seems to be on track regarding the supply of safe water sources. Regarding basic sanitation (latrines), however, the achievement of the MDG target seems impossible.

Funding available for the water sector

To what extent the WSS-related MDGs for rural Benin can be achieved certainly depends on the inputs provided, financial funds – for new investments, repair, rehabilitation and replacement of infrastructure – being the most important one.

In recent years, water supply in rural areas has featured higher than before at the level of the national budget. Changes in public finance management were part of Benin's Poverty Reduction Strategy Paper (2001-2006), and of the Growth and Poverty Reduction Strategy (CSLP 2007-2009). Rural drinking water provision is one of the priority themes in both documents. A combination of sector co-ordination and a results-based management approach is used to ensure that budget allocations reflect government priorities. This change is reinforced by the introduction of a single budget per sector, which brings together all funding mobilized from the government budget and from external sources (donors). The introduction of the Medium Term Expenditure Framework (MTEF) supplements this new procedure. The MTEF enables multi-annual expenditure planning and offers more predictability. This change does require that sector ministries anticipate and plan their expenditure in time.

In 2002, the rural drinking water sector requested the application of this budgetary reform to its own operations. The MEE now produces an annual objectives-based programme budget (BPO – Budget Programme par Objectif) for each sub-sector, based on medium-term objectives (three years) centred on the MDGs. The BPO is an important tool for reinforcing coordination within the rural drinking water sector (CPLB-Benin, 2009).

The available sectoral budget, containing both domestic and external resources, actual expenditure and disbursement rates are presented in Table 2 for 2007 to 2009. It should be noted that the data is sourced from the DG Eau and was found to contain a number of discrepancies. It is, however, reported here as it was provided. Furthermore, it should be noted that technical assistance which might be provided complementary to financial contributions for infrastructure, as is the case with German technical assistance, is not included in the table. Therefore, the contributions of Protos, Helvetas, UNICEF and Plan are also not included.

According to the DG Eau data, the amount allocated in the national budget has fluctuated around EUR 5 million per year, with a somewhat declining trend over the period presented in the table. The pledges from international donors for rural water and sanitation have also declined over this period, amounting to only EUR 13 million in 2009, according to DG Eau figures. Disbursement rates have been highly volatile and have tended to be well below the amounts pledged. Among the group of donors, they tend to be lower for those transferring their resources via the Ministry of Finance. However, actual installation of water points is higher as private sector companies agree to start working without a contract and pre-finance the costs (see next section).

Table 2: Planned budget, actual expenditures and disbursement rates in the rural water sector budget (2007-2009) in EUR 000

Source of finance	2007			2008			2009		
	Budget	Expenditures	Disbursement rate	Budget	Expenditures	Disbursement rate	Budget	Expenditures	Disbursement rate
National budget	5,799	3,980	69%	5,292	3,761	71%	4,669	1,242	27%
International donors	24,834	9,831	40%	21,573	8,943	41%	13,107	15,168	116%
Pot Commun Initiative Eau	2,578	95	4%	5,068	1,472	29%	531	2,703	509%
Total	**33,215**	**13,912**	**42%**	**31,939**	**16,033**	**50%**	**22,692**	**15,592**	**69%**

Source: Compiled by the DG Eau (figures could not be verified by individual donors)

Target realisation – installed water points

Improving access to drinking water is one of the Millennium Development Goals. The target is to halve in 2015 the proportion of the population that was found to lack access to safe drinking water and sanitation in 2000. The baseline for the rural population in Benin has been set at 35% in 1990 and the target for 2015 is 68% of the rural population having access to improved drinking water.

The annual installation rate of safe water sources in rural Benin is reported to have risen from 550-600 in 2002 to over a 1000 equivalent water points or EPEs in 2004 (see Table 3), but then dropped in 2005, partly due to a lack of pumps (Danida, 2004; DGH, 2006). Progress for new installations was slowing down again in 2007.[31] The majority of the 429 EPEs realised in 2009 outside the sector programme were funded by Japan (100), Plan-Benin (94), UNICEF (84), Padro (80) and PROTOS (40). In 2008, the total number of water points was estimated at 18,641 EPEs[32], 11% of which were not functioning. Working on the assumption that one EPE serves 250 people, this meant that 49.9% of the population had (reasonable) access to drinking water (see Table 3).[33]

The data in Table 3 indicate that Benin is on track for achieving the drinking water target. Attaining this goal is achievable if work proceeds at an average rate of 1,450 EPEs per year and there are no unexpected increases in the attrition of the modernized water sources.[34] In this regard it is important to take into account the high rate of abandoning water points after 3-5 years (see section 4.2 for details), which may not have been considered correctly in this calculation. In addition, it should be noted that the reliability of the data presented in Table 3 has been a topic of discussion between donor representatives and the Government of Benin. The data presented were reported to give a reasonable but not necessarily fully reliable picture of the number and the increase in the number of drinking water installations (see also slight discrepancies for EPE delivered 2007 and 2008 between Table 1 and Table 3).

[31] This was mainly because of a lack of completed community applications for water points, the long time required for finalizing procurement procedures, the mismatch between availability of funds (around June–July) and accessibility of rural areas for the heavy drilling equipment. The best period for drilling is during the dry season in the beginning of the year. The rainy season normally starts in June.

[32] An equivalent water point (EPE) gives the drinking water supply expressed as a level of service. Current standards in Benin are one water point (EPE) per 250 people, based on 20 litres per person per day and a maximum distance of 500m to transport the water. The standard was 500 persons per EPE until 2000, but was reduced to 250 persons per EPE to improve the level of service.

[33] The cost of these works is affected by the frequency of scattered settlement, where 45% of the rural population live. The geology of certain parts of the country makes it hard to find 'positive' points (i.e. points that deliver water). Other technical difficulties are the depth of the water table and infiltration of salt water in areas close to the sea. During the rainy season, the north is inaccessible for heavy drilling equipment.

[34] It should be noted that the ambitions of the national budget programme are even higher than the MDGs.

Table 3: Rate of drinking water installations in EPE (2003-2009)							
	2003	2004	2005	2006	2007	2008	2009
Total EPE Planned							
MDG target			1,262	1,402	1,291	1,334	2,831
Programme budget (BP) target		1,221	1,111	1,678	2,275	2,316	2,064
Total EPE Delivered							
New EPEs –BPO	431	1,010	761	1,206	1,035	1,456	1,811
Renovated EPEs – BPO	176	203	139	487	829	362	73
New EPEs –other actors						33	429
Renovated EPEs – other actors						68	269
Total EPEs delivered	607	1 213	900	1,693	1,864	1,937	2,313
Aggregate EPEs at year end	10,940	11,950	12,711	16,083	17,162	18,641	20,825
Percentage population served (%)	36	39	41	44	46,5	49,9	55,1
Percentage of EPEs not working (%)		17	16	14	13	11,1	10,2

BPO = Objectives-based programme budget. EPE – Equivalent water point.

Source: (DG Eau, 2007; DG Eau, 2009; DG Eau, 2010a; DGH, 2006)

This rather positive outlook regarding the MDG on rural water supply, however, stands in sharp contrast to the situation in rural basic sanitation.

Target realisation – latrines

With a baseline of 1% of the rural population with access to an improved sanitation facility in 1990, Benin would have to reach a total of 51% of the rural households with access to an improved facility by 2015. In 2008 the percentage was only 4.[35]

The following results were reported with respect to the construction of latrines for 2008 and the period from 2005 to 2008, showing the rate of realisation, particularly for private latrines to be very low.

35 WHO-UNICEF Joint Monitoring Programme progress on sanitation and drinking-water update, 2010.

Table 4: Realisation of latrine construction in 2008

Département	BPO targets 2008		BPO targets realised 2008		% of targets realised		Total targets 2005–2008		Total targets realised 2005–2008		% of targets realised	
	FT*	TI*	FT	TI	FT	TI	FT	TI	FT	TI	FT	TI
ALIBORI	3700	105	261	197	7.05	187.62	59540	1916	1910	758	3.21	39.6
ATACORA	4200	173	0	192	0	110.98	71250	2814	0	526	0	18.7
ATLANTIQUE	6700	173	621	214	9.27	123.7	147900	5164	2668	592	1.8	11.5
BORGOU	5000	189	1077	140	21.54	74.07	80700	4420	2147	732	2.66	16.6
COLLINES	6000	210	316	99	5.27	47.14	98500	3959	1360	0	1.38	15.7
CUOFFO	3300	194	0	120	0	61.86	64800	4008	0	120	0	2.99
DONGA	1800	158	0	172	0	108.86	41000	2566	0	509	0	19.8
MONO	1950	158	0	90	0	56.96	49300	3217	0	90	0	2.8
OUEME	2500	210	600	218	24	103.81	78550	4213	0	442	0	10.5
PLATEAU	1500	158	0	237	0	150	51150	2390	0	520	0	21.8
ZOU	2850	200	769	266	26.98	133	66350	3663	1453	644	2.19	17.6
BENIN	39,500	1928	3644	1945	9.23	100.88	808,950	38,330	9538	5556	1.18	14.5

**FT: Family toilet, TI: Toilet in institutions (mainly schools) (DHAB, 2009). It should be noted here that public toilets are not improved sanitation facilities as per the JMP definition.*

Even if there are doubts concerning the accuracy of these figures in detail, the conclusion will not change: the failure in achieving the MDG on rural sanitation is almost certain. The reasons for this are numerous, one of them being the expectation of the government strategy that households provide their own finance for latrine construction. Obviously, this strategy does not match the priorities and or the financial capabilities of private households. More information on the reasons for failure can be expected in the following chapters.

2.6 Summary

The Beninese rural water sector operates in a challenging environment of physical constraints and a changing policy and institutional framework. As outlined in section 2.2 on the country context, the natural and demographic make-up of Benin presents a number of issues for rural water supply. Waterborne diseases present a major challenge to public health, while access to safe water and more so to improved sanitation facilities is generally poor, especially in rural areas. Another aspect of the problem is the natural environment through the variation in rainfall. The impact evaluation takes account of regional variations by collecting data in a diverse set of departments both in the dry and in the rainy season.

Latrines in institution

Against this background, the strategies and institutions governing the sector, as described in section 2.3, have undergone various reforms with the aim of improving the delivery of water supply and sanitation services. At present, the water authority (DG Eau) is in charge of rural drinking water. The water authority is responsible for facilitating investments in drinking water provision and regulating the sector. DG Eau is part of the Ministry of Energy and Water Engineering and has offices in each of the twelve departments.

The most important change relevant for this evaluation is certainly the revision of the national rural drinking water strategy to improve the equitable allocation and sustainability of water points. Moving away from allocation-based on-demand from communities, municipalities are expected to allocate new water points based on information on already existing availability of water points in relation to population density and distance to be covered to reach the nearest water point. The revised strategy further brings about a shift of management responsibilities and ownership for local water points from local water user committees and associations to municipalities and contracting out of management services to private sector companies. The revisions are in line with ongoing delegation of formerly central governments' responsibilities to the municipality level. However, fiscal decentralization has not kept pace with the municipalities' increased responsibilities.

As mentioned in section 2.4, donors play an important role in funding and implementation of the rural drinking water strategy. Harmonization and alignment have been pursued since the 1990s, initially in the framework of a multi-donor project (PADEAR). A sector programme, including a medium-term expenditure framework and performance indicators, was developed in 2002. Donors adhere to the national strategy, but there are differences in

support provided across *départements* and municipalities in terms of resources (both in terms of amounts as in terms of the way these funds are made available) and technical assistance provided. Finally, section 2.5 on target achievements brought to the fore that Benin is on track towards achieving the MDG target for drinking water infrastructure, but the country lags far behind in the achievement of targets for improved sanitation facilities.

The upcoming impact chapter intends to add to the body of evidence on how the national strategies and achievements described above translate into improvements in the living conditions of the affected population. The focus on rural areas does justice to the fact that this is where most of the poor live and where the general situation regarding health and water supply is most critical.

3

Impact analysis

3.1 Introduction

This chapter provides quantitative estimates of the impact of water and sanitation interventions in Benin – implemented by the Government of Benin and realised with donor support. It addresses the evaluation questions 5 to 23 listed in Chapter 1. The aim of this chapter is to investigate to what extent observed changes in relevant outcomes can be attributed to the supported water and sanitation interventions.

The chapter is organized as follows: the current section briefly describes data sources, sampling and the methodology applied for this impact evaluation. Section 3.2 outlines the water and sanitation infrastructure at the start of the evaluation and describes the planning and realisation of additional infrastructure over the evaluation period (2008–2010). Sections 3.3 to 3.5 analyse the impact of water infrastructure interventions on a number of outcomes: use of improved versus alternative sources; quantity collected and quality of water (at source and at point of use); and distance and time spent on water collection. Recurring questions are whether measured impacts depend on a) whether the improved water source is the first in the locality and b) whether seasonal (dry and rainy season) variations exist. Section 3.6 analyses existing sanitation and hygiene practices and impacts of sanitation and hygiene promotion on these practices. Section 3.7 investigates the impacts of water as well as sanitation/hygiene interventions on health outcomes. Last, section 3.8 provides evidence on pricing and cost recovery of water and sanitation infrastructure. Each section starts with the question(s) addressed and the answer to these questions and proceeds with supportive evidence. Section 3.9 provides a summary and conclusion of this chapter.

Interview with a household member

Data sources

This chapter is based on data collected in a series of four surveys: two surveys have been conducted in the dry season (February 2009 and 2010 in the *départements* Mono-Couffo and Collines) and two surveys have been conducted in the rainy season (July 2009 and 2010 in Collines only).[36] The report uses the following data sets obtained by these surveys.

- **Household survey** data from interviews with 2,000 households in 200 localities provide information, among others, on household composition, basic welfare indicators, information on use and perception of water and sanitation infrastructure, hygiene knowledge and behaviour, water quantities collected, time spent on collection, and health outcomes for all household members.
- **Locality survey** data from interviews with representatives of 200 localities provide information on locality infrastructure, NGO and governmental project activities, installation and use of individual water points, and water management.
- **Microbiological tests** analyse the water quality of the main locality water source, and of the water in households' water storage containers (140 localities and 1400 households).
- **School survey** data provides information on enrolment rates, water sources and sanitation in the 200 schools that were attended by the majority of the children of the respective localities analysed.

[36] Since the rainy season survey mainly serves to check the seasonal differences it was decided to include only one of the two survey regions. Collines was chosen because the seasonal differences were expected to be more pronounced there.

Sample selection

The following *départements* were initially chosen for the study: Mono and Couffo (in the south), Collines (in the centre) and Borgou (in the northeast). Since Mono and Couffo are relatively small and neighbouring regions, they are treated as one survey region, Mono-Couffo and throughout this study it is referred to as one survey region. Note that the follow-up survey in 2010 did not include Borgou; reasons for this change are discussed in Section 3.2. In the remainder of the report, Borgou is therefore omitted from the analysis unless stated otherwise.

The survey design follows a 'two-stage clustered' sampling procedure: first, in each of the two survey regions 100 localities were chosen (in total 200 localities). In a second step, within each locality 10[37] households were randomly sampled (in total 2000 households).[38] [39] Localities were used as the primary sampling unit since interventions by the water service (S-Eau) in Benin are planned and executed at the locality level. The selection of the localities within the regions was not random as it had to follow a number of demands specific to an impact evaluation: First, only localities where a water intervention was planned between 2008 and 2010 were selected for the impact evaluation.[40] Second, sampling was done in such a way that, taking into account planning uncertainties, the expected number of treatment localities (new water points in 2009) and control localities (new water point in 2010-2011) was about 50:50 in each department. However, within these preselected groups, localities were sampled randomly from larger *départemental* water service planning lists.[41] The survey samples are thus representative of the population of localities planned to receive a new water installation in the period 2008-2010 within the *départements* studied; however, the sample was not intended to be nationally representative. The map in Figure 4 presents the treatment and control localities that were visited during the surveys in Mono-Couffo and Collines.

37 A fixed number of households per locality was chosen – and not a number proportional to locality size because of small localities and organizational considerations. To obtain representative population statistics, household sampling weights could be applied. For the analysis in the following chapters, we chose to use locality weights instead of household weights, to give small localities the same weight as large localities and to reflect the fact that programmes are planned at the locality level and not at the household level.

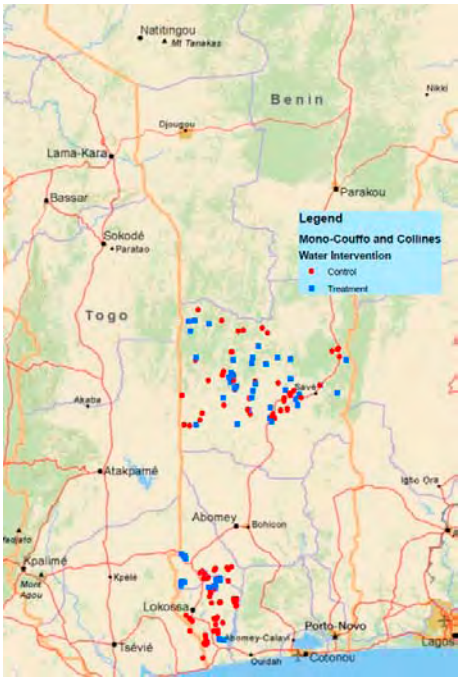
38 Localities are the smallest administrative unit in Benin with an average size of 81 households. In Benin, the term 'village' refers to a collection of several localities.

39 Six localities had fewer than ten households and hence all households within the locality were interviewed.

40 Hygiene promotion planning was only available for Collines, which was taken into account in locality selection.

41 The sampling took account of differences between regions regarding data availability (S-Eau's have varying degrees of data availability). In general, the counterfactual can be improved by selecting controls using covariates that are available before the survey. For Collines this was the case so that treatment and control localities could be selected using matching techniques. For Borgou and Mono-Couffo random sampling from treatment and control strata was done.

Figure 4: *Map with water planning and sample localities*



Legend

Mono-Couffo and Collines Water Intervention

Control

Treatment

In addition, three sub-samples were drawn from the above described sample for three specific survey questions:

- In order to study seasonal differences in outcome and impact variables, it was decided to also collect data during the rainy season (July-August) but only for the survey region Collines (hence 100 localities and 1000 households). Collines was selected because the differences of water access and use between dry and rainy season were considered to be particularly important for this region.

- It was decided to conduct water tests in a sub-sample of 70 (out of 100) localities per *département*. Thus a random sample of 70 localities (and hence 700 households) was chosen per region from the full sample of survey localities (in total 140 localities and 1400 households).

- After the baseline survey, an additional random sample of 37 localities that already had an improved water source (from control and treatment localities) was drawn. Improved water storage and transport containers were distributed among 370 households to analyse the impact of improved point of use water infrastructure in addition to improved water source infrastructure.

Methodology

The methodology of this study is quasi-experimental, consisting of a combination of a double difference impact estimation with a pipeline approach. The main characteristic of a double difference impact estimation is that it analyses data that were collected before (baseline survey) and after (follow-up survey) an intervention in both treatment and control localities. To ensure that treatment and control localities are comparable a so-called 'pipeline' (or 'phase-in') approach is applied, where the control localities (and hence the counterfactual) is sampled from localities that have already been selected for (later) treatment and are therefore comparable to the treatment localities. Hence, treatment localities have been identified as those that receive a water intervention in 2009 and control localities are those that are planned to receive an intervention shortly after.[42] A survey is conducted before (February 2009) and after (February 2010) the interventions, which allows controlling for initial differences between localities.

The results in this chapter are generally shown as double difference tables.[43] Double difference tables provide mean outcomes by treatment and control group for 2009 (baseline) and 2010 (follow-up) and the differences/changes over time for both groups, to finally estimate the effect of the intervention on the outcome of interest (double difference-estimator). In other words, the change in the outcome variables of interest between 2009 and 2010 is calculated for the (intervention) localities where a new water point was built in 2009, as well as for the localities where improved water access did not change during the same period (the counterfactual). The difference between the change over time in outcome variables for the treatment localities on the one side and the control localities on the other side is the estimated causal impact of the intervention.

[42] Given that control and treatment localities were scheduled for water treatment within the space of 1 to 2 years and given that the water intervention programme has been going on for several years, it can reasonably be assumed that control and treatment localities are not much different from each other. Furthermore, the double difference approach allows one to account for differences in outcomes before interventions.

[43] For all double difference tables, double difference regression analyses were also conducted to check for statistical significance and robustness.

3.2 Planning and realisation of water and sanitation infrastructure

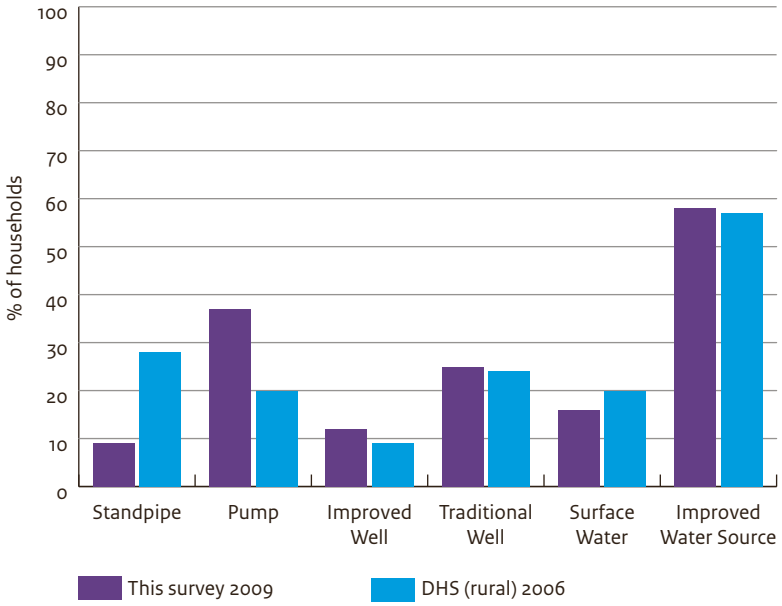
Evaluation question 5: *What was the water supply infrastructure in the localities before the interventions? What additional water supply infrastructure has been realised over the study period of one year?*

A majority of households (58%) was already using an improved water source at the start of the study. The 2008 and 2009 water infrastructure realisation rates (realised water points/planned water points) appear low (50%–60%) and delayed. Borgou, one of the three original survey areas, was even dropped from the study because realisation of infrastructure was so low that an impact analysis would not have been meaningful (see Box 3).

Water infrastructure at baseline

Figure 5 presents the shares of main drinking water sources at the start of the impact study. The dark bars present water use according to the baseline survey data (dry season, February 2009). The light bars give the distribution of main water sources according to the 2006 Demographic and Health Survey (DHS). These figures show that more than half of the households (58%) in the survey areas (Mono-Couffo, and Collines) already used an improved water source at the start of the study. The internationally agreed definition of improved water sources includes household connection, public standpipe, borehole, protected dug well, protected spring and rainwater collection. Throughout this quantitative impact evaluation we follow this approach, but treat rainwater collection as a separate category, to clearly show differences in water use between the dry and rainy season. This percentage is in line with the percentage of households that use an improved water source in rural areas in general according to the DHS 2006. But these figures also show that a sizable percentage of households in rural Benin still uses traditional wells or surface water as their main source of drinking water. Last, the figures indicate that the localities on the water planning lists for an improved water source do not have worse or better access to an improved water source than localities in rural Benin in general.

Figure 5: *Baseline survey 2009 (Mono-Couffo and Collines) and DHS 2006 – Types of water source*



Sources: Household baseline survey; own calculations based on Demographic and Health Surveys (DHS) 2006

Realisation of water infrastructure

To answer the question whether infrastructure targets were achieved, water point planning lists for the year 2008 and 2009 are compared with actual realisation of water service delivery between 2008 and 2009. First, it is important to note that the realisations reported by the S-Eau in Borgou for the year 2009 were so low that implementing the planned impact assessment survey at the beginning of 2010 was considered not worth the cost and effort. In December 2009, out of 71 localities scheduled to receive a water point in 2009 in Borgou, only one was confirmed to have been implemented (see Box 3 for further explanation). Hence, the remainder of this chapter is based only on data for the survey regions Mono-Couffo and Collines.

Table 5 is based on information from the locality questionnaire. The years in the column headings (left to right) indicate the year in which, according to plan, new water points would be installed. The years in column 1 (top to bottom) represent the most recent year a water intervention was realised in a locality. A water point is considered as realised if respondents of the locality survey indicated at the beginning of 2010 that (i) a water point had been put into use within the boundaries of the village[44] in a particular year and (ii) could actually be used by the population of the locality at the time of the survey.[45]

[44] A village may consist of one or more localities.

[45] This definition of a realised water point is equal to locality water treatment and is used throughout the impact assessment of this chapter.

Waterpoint

What percentage of the planning targets was achieved? The second column of Table 5 shows that of the 200 localities in the sample, 40 were on the planning list for 2008. In 15 (38%) of these 40 localities, a water point had not been realised even by the beginning of 2010; in 4 (10%) localities, the realisation took place in 2008 (as planned), and in 21 (52%) of the localities scheduled for 2008, the water point was realised only in 2009. Hence, for 2008 and in a narrow sense ('water point put to use in the year planned'), only 10% of targets were realised. Taking into account the water interventions in 2009 that were on the planning list for 2008 (and hence a delay of one year), 62% of the targets for 2008 were achieved. For the 2009 planning list, the 'narrow' target of realisation was achieved in 51 out of 103 localities. In other words, 49% of the new water points planned for 2009 were realised and put to use in 2009.

Table 5: Water planning and realisation

Realisation : Water point constructed in the year:	Planning: Water point planned for the year:			
	2008	2009	2010	Total
	No. (%)	No. (%)	No. (%)	No. (%)
	40 (100%)	103 (100%)	57 (100%)	200 (100%)
Not yet realised	15 (38%)	49 (48%)	**49 (86%)**	113 (56%)
2008	**4 (10%)**	3 (3%)	2 (4%)	9 (5%)
2009	21 (52%)	**51 (49%)**	6 (10%)	78 (39%)[46]

Note: Planning lists are from 2008. Realisation of water points was observed in January 2010.

The 2008 and 2009, realisation rates (in the narrow sense) of 10% and 49%, respectively, display remarkable variation and are low on average. It should be mentioned, however, that the water service planning and financing is based on a realisation rate of 60% to 70% of the planned works, which is often attributed to forages negatives (groundwater not found). With this in mind, the realisation is slow but might be considered as satisfactory if a one-year delay in implementation is acceptable (given problems of funding, planning and contracting). One can, however, also observe that in 3% of the localities planned for 2009, and in 14% of the localities that were scheduled to receive a water point only in 2010, a new water point was installed in the year before planning.

Box 3: *Borgou*

Borgou requires special attention in our study. This *département* was selected as one of three survey regions, alongside Mono-Couffo and Collines. A uniform process of sampling (2008) and baseline data collection (February 2009) was followed in all three regions. However, in January 2010 it was decided to not pursue data collection in Borgou resulting in no impact results for this *département* in this chapter.

Why was data collection suspended in Borgou? The double difference method employed in this study requires that a sample of treatment and control localities is chosen before the baseline study so that data can be collected before (baseline survey) and after (follow-up survey) an intervention in both treatment and control localities (see Section 3.1 for details). Treatment, in our case new water point installation, hence has to be implemented before the follow-up survey: otherwise the impact of the intervention cannot be measured.

[46] These 78 localities, that actually received a new water point in 2009, later on form the treatment group as defined in Section 3.1. All others are defined as control localities: both, whether they already received an improved water point before 2009 or not.

Therefore, either the follow-up survey has to wait until the water points have been installed or, in case the timing of the follow-up survey is not flexible, the planning has to be carried out without much delay. Since it was not possible to delay the follow-up survey, as reporting to the Dutch parliament was scheduled for 2011, the timing of water point implementation was crucial, and had to follow the provided planning lists. For the case of Borgou, the realisation of infrastructure lagged so far behind planning for the year 2009 that a follow-up survey to measure impact in February 2010 would have been useless.

At the end of 2009 the study team tried to obtain indicators of water point implementation progress in all *départements* in the study. This type of information is not centrally available to donors in the short term, e.g. through the Embassies or through the water directorate (this information is centralized only after some time) but has to be obtained from *départemental* water services, technical assistants or engineering firms. For Mono-Couffo and Collines, information on progress was supplied on time, showing that progress was not perfect but sufficient to make the decision to implement the follow-up survey at the beginning of 2010.

In Borgou, there were two main problems: first, it was very difficult to obtain information on planning and progress. Several requests from the evaluators and Embassy staff for progress information remained unanswered by the water service (a Dutch evaluation mission to Borgou had to return empty-handed). Secondly, when the information on implementation progress was finally provided in December 2009, it showed that out of 71 localities scheduled to receive a water point in 2009 only one (1) was confirmed to have been implemented in 2009. Of the remaining 70 localities, 4 were not reported, 15 were reported en cours 2009, and 51 had been shifted to the planning for 2010, 2011 or 2012.

Allocation of water infrastructure

Evaluation question 6: *Are there differences between localities regarding their probability of having access to an improved water source?*

Of the water points realised during 2009, 40% were allocated to localities without any improved water point before the intervention, and an additional 22% were constructed in localities were service levels were low (more than 50 households per improved water source). 38% of water points were, however, built in localities with already sufficient service delivery; also, before the installation of the new water point these localities were not disadvantaged in terms of distance to the existing sources for the average household. Moreover, in the past, wealthier and larger localities were more likely to gain access to an improved water source, which was, however, not the case for 2009.

The institutional aspects of the process of locality self-selection into water programming have already been described in detail in Chapter 2. The outcomes of this process are quantified in this section. Table 6 provides the number of improved sources at baseline (column 1); the number of households per improved water point as an indicator of service

quality (at baseline, column 2); the average share of locality households indicating that their distance to their main water source is more than 1 km (at baseline, column 3); and the share of localities with a realised (column 4) water point in 2009 that fall in each category of water service delivery.

Table 6: Allocation of planned and realised water points

Baseline: Number of improved sources	Baseline: Average number of households per improved water source in 2008	Baseline: Average share of households with reported distance to improved water source > 1km	Follow-up: % of all localities that received a new water point in 2009 that fall into one of the service categories
0	32*	36%**	40%
1	105	24%	22%
2	38	8%	21%
3	47	6%	8%
More than 3	45	5%	9%
Total			**100%**

* *number of households per locality, no improved source yet; **distance to any water source*

Note: Percentages in column 4 add up to 100%. For example, this implies that of all water points built, 40% were built in localities with no prior improved water point access, 22 were built in localities with one improved water point already, etc.

Table 6 shows that improved water points were implemented primarily in localities where previously no improved source existed. This 'first-time access' represents about 40% of the 2009 locality interventions. This implies that in about 60% of localities where a new water point was planned and realised during 2009, an improved source was already used before the intervention took place. The second column of the table does, however, also show that in some cases – where only one previous improved water source existed – a second source is indeed needed to provide an adequate service level: the mean number of households per water point in localities where only one improved source was available at baseline and an additional water source is planned is 105 (or 600 individuals).[47] A second source reduces this to about 50 households (or 300 individuals). In this sense, the planned and realised allocation of an additional water point to localities with already one and exactly one water source at baseline looks reasonable.

For localities with more than one water source already at baseline, the service level seems, however, adequate, and the question is why 38% of realised water points in 2009 were allocated to these localities. One objective reason might be that these are dispersed localities where households, before the installation of an additional water point, on average have to cover a large distance from their home to the existing improved water

[47] Note that even though localities are the smallest administrative unit in Benin with an average size of only 81 households, some of them might be so dispersed that because of distance, more water points than 1 per 50 households might in some (rare) cases be justified.

point. Column 3 shows that this is not the case: the share of households indicating at baseline a 'large distance' (> 1 km) to their main water source is relatively small in localities with two or more improved water points.

Prior to 2010, the water allocation process was largely demand-driven (see Chapter 2 and Chapter 4 for further explanation). This is certainly one reason why the observed pattern of repeated allocations to the same localities took place, even where service levels in terms of households per water point were already adequate. Currently, there is a shift towards more centralized 'database planning' with higher priority given to localities with large populations relative to the existing infrastructure.

To understand the distributional outcome of this longer-term demand-driven process of water allocation – that also led to the observed differences in the number of improved water sources per household – a regression analysis was applied, analysing which factors increased the probability of a locality to already have an improved water source in 2009. The findings indicate that – at least in the past – both wealthier and larger localities tended to have a higher probability to gain access to an improved water point than poorer and smaller localities.[48] Controlling for population size and wealth, and accessibility by road seem to have no effect on the likelihood of improved water access.

These regressions are descriptive in nature and do not necessarily have a causal interpretation. Nevertheless, they are not difficult to interpret: during the demand-driven water allocation a locality needed a certain minimum purchasing power to make the initial investment of about EUR 200. The locality purchasing power is determined by the number of households contributing and their mean wealth. It is not clear, however, that in terms of water points per capita the larger localities are always better-off. Localities can also mobilize these initial investments through linkages with politicians or diasporas (see Chapter 4). The likelihood that somebody within a locality has connections to an external fund also clearly increases with locality size.

Sanitation infrastructure at baseline

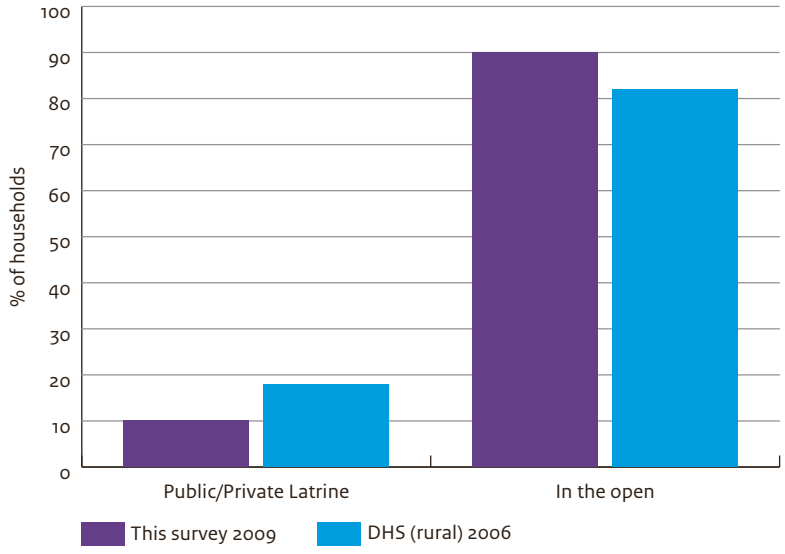
Evaluation question 7: *What was the sanitation infrastructure in the localities before the interventions? What additional sanitation infrastructure has been realised over the study period? Are there differences between socio-economic groups regarding their probability of having access to a sanitation intervention?*
Sanitation coverage is very low in rural Benin, especially in the study areas. Before the analysed interventions only 10% of households had access to improved sanitation. Whereas for the last year, no differences between socio-economic groups regarding their probability to get access to a hygiene/ sanitation interventions can be detected – and only an additional water point increases the likelihood

[48] The survey data include a list of assets for each household. They have been used to calculate a per capita wealth indicator based on principal components analysis. The wealth indicators allow the calculation of wealth quintiles and these are used to define a poverty indicator. The poverty indicator equals 1 if the mean of the locality respondents' wealth quintiles is in the two bottom quintiles of the wealth distribution of the entire sample, and 0 otherwise.

to receive a hygiene/sanitation project – for the last five years, sanitation infrastructure and hygiene education clearly negatively discriminated poorer localities.

Figure 6 presents the use of private and public latrines in rural Benin. The dark bars present sanitation use according to the baseline survey data (dry season, February 2009). The light bars give the distribution of sanitation use according to the 2006 Demographic and Health Survey (DHS). These figures show that more than 90% of households in the survey areas (Mono-Couffo and Collines) have no access to any kind of sanitation – in comparison to 'only' 42% of households which do not have access to an improved water source. This percentage is also much higher than the 2006 DHS data (rural areas only), where 80% of households report open defecation. Hence, the use of sanitation facilities is very low in rural Benin in general, and in the localities scheduled for an improved water source in 2009 in particular. Note, that in this section and in the following the initial dichotomous definition used by WHO-UNICEF for the Joint Monitoring Programme for Water Supply and Sanitation, of improved and unimproved sanitation has not been used,[49] but the latest sanitation ladder, making the difference between open defecation and any access to simple or improved sanitation. This distinction is more relevant to rural Benin, where private improved sanitation is very rare.

Figure 6: *Baseline survey 2009 and DHS 2006 – Types of latrine*



Sources: Household baseline survey; own calculations based on Demographic and Health Surveys (DHS) 2006

[49] Improved sanitation facilities: connection to public sewer, connection to a septic tank, pour-flush latrine, simple pit latrine, ventilated improved pit latrine.
Unimproved sanitation facilities: public or shared latrine, open pit latrine, bucket latrine.

Sanitation realisation and allocation

Whereas for water supply quite detailed planning lists existed for both Collines and Mono-Couffo, which allowed a comparison between planning and realisation rates, sanitation interventions, including the promotion of hygienic behaviour and the construction of public and private latrines, seem to happen more on an ad hoc basis in rural Benin. For Mono-Couffo no sanitation planning list was available (at least for the evaluators), and for Collines this list was not detailed on a year-to-year basis. However, both the DG Eau (Direction Générale de l'Eau) and DHAB (Direction Hygiène et Assainissement de Base) stated in several interviews that, in general, water supply interventions should – and would be – accompanied by hygiene education.

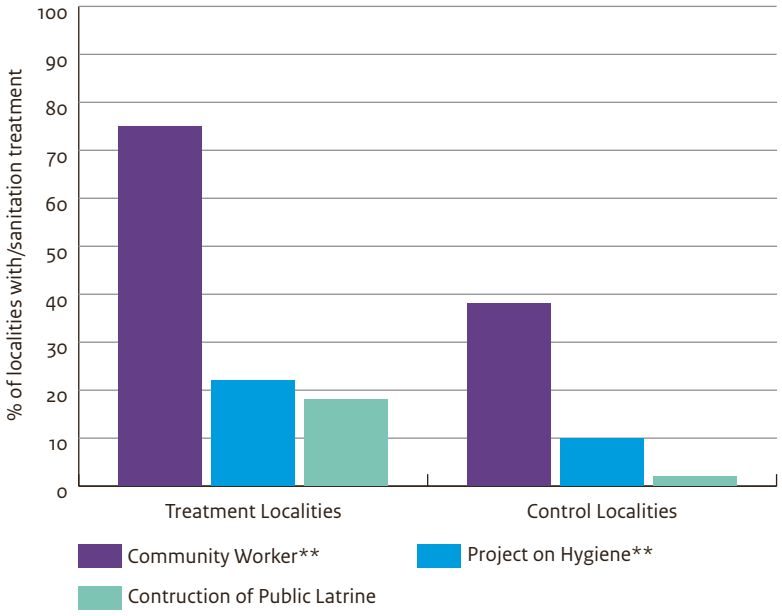
About 40% of localities received a new water point during 2009, but at the beginning of 2010 only about 6% of locality heads reported that a project (NGO or governmental) started to work on issues related to hygiene and sanitation in the last 12 months. A new public latrine was installed in only 3% of the localities during 2009. In about 25% of localities, householders remembered that a community worker talked about hygiene-related issues during 2009.[50] Note that some localities could have benefited from all three interventions.

The more important question is whether these low rates of hygiene and sanitation interventions were at least coordinated with the construction of an improved water source. Some 10% of localities that received a new water point (in general or first-time access) reported that a hygiene/sanitation related project was initiated, and in about 35% of localities that received a new water point households could remember that a community worker talked about health related issues. In localities that did not receive a new water point, only 5% reported the presence of hygiene/sanitation projects and only 19% had households that could remember that a community health worker talked about hygiene related issues (see Figure 7).

Hence, localities that received a new water point (both in general and first-time access) were about twice as likely to host a project starting to work on hygiene and/or sanitation in the last year and/or a community health worker than localities that did not receive a new water point. Nevertheless, the coverage rates of localities receiving a new water point with a sanitation intervention still appear to be low. Furthermore, there is no difference in the likelihood to host a hygiene/sanitation intervention depending on whether the locality receives its first water point or a second, third or fourth water point. Moreover, no significant correlation could be found between installation of a new water source and the construction of public latrines (Figure 7).

[50] Here and in the following chapters, a locality is considered as having been visited by a community health worker if at least two households could remember that a community health worker was present within the last year.

Figure 7: *The percentage of water treatment and water control localities that received sanitation treatment*



*Note: ** significant at 5% level*

Taking a longer-term perspective and looking at the previous five years (2005-2009) of water and sanitation interventions (and not only at 2009), 58% of the localities received an improved water source between 2005 and 2009, 20% a project on hygiene and sanitation, 10% a new latrine, and 39% a community health worker. Hence, the large difference between water supply coverage and sanitation intervention coverage diminishes to some extent when taking a long-term perspective.

Last, a regression analysis shows that during the period 2005-2009, the probability of a locality receiving a hygiene/sanitation project was not positively correlated with the installation of a new water point – whereas during the last year a new water point indeed increased (even if not sufficiently) this probability. During the 2005-2009 period, the wealthier localities had a higher probability of benefitting from a hygiene/sanitation project and or a public latrine than poorer localities.

3.3 Water use[51]

Evaluation question 8: *What has been the change in the proportion of the population using an improved water source? Are there differences across socio-economic groups with regard to water use?*

The installation of a new water point leads to an increase of 30 percentage points of households collecting water from a safe water source. In case the new water point is the first ever installed in a locality, the impact is an increase of 74 percentage points (from 0 users). Hence, a newly installed water point considerably increases the proportion of the population using an improved water point, but not everybody uses an improved water source even if accessible. Although poor households, female headed households and nomads (Peulh) are less likely to use an improved source in general, they do not use the newly installed water points of 2009 more or less than other households.

Table 7 shows the double difference estimate of the effect of the construction of an improved water source on the use of an improved water source. The structure of this table is used throughout the study and therefore it is discussed in some detail here. The table has a left panel labelled 'All interventions' and a right panel 'First-time access'. The left panel is based on the general definition of water supply: The treated localities in this definition include both those localities where a new improved water point is added during 2009 to one or more pre-existing improved water points and those where the improved point installed in 2009 is the first. The right panel restricts the treatment group to those localities which did not have any improved water point before the 2009 installation (first-time access). Furthermore, the p-value of the impact coefficient in the corresponding regression (without additional covariates) is reported.[52] In all cases the robustness of the result using this simple model has been checked by adding a number of other covariates. For matters of readability results of these more elaborate regressions are discussed only in cases where they yield a non-marginal difference in the estimated impact coefficient or when they relate to a particular evaluation question.

[51] Water use (and water quantity) is defined as the source that households reported to use as their main and/or secondary water source for drinking. In almost all cases households reported using this water for purposes other than drinking.

[52] P-values represent the probability that the impact (coefficient) is zero. In other words, a p-value of (or close to) zero means that the coefficient is 'significantly different from zero'. A coefficient for which the p-value is much higher than 10% (or 0.1) is considered 'not significant', i.e., one should conclude that the variable for which it is estimated does not have an effect on the outcome variable.

Protected well

Also note that the control group for 'first-time access' is the same as for the 'all interventions' case. It could be argued that for first-time access localities, a more appropriate control group would consist of 'never access' localities, those that do not have an improved water point either at baseline or at follow-up. This was not feasible since there are only very few of these 'never access' localities in our sample, reflecting the fact that locality-level access was already widespread at baseline. However, the heterogeneous control group can be defended using several arguments. First, the double difference technique ensures that level differences between control and treatment are controlled for. Second, the tables show that the levels observed in the control group used are not extreme in the sense that they cannot go up (which would make a zero impact almost impossible when compared to first-time access localities). Third, since the main objection would be differential trends in the alternative control groups, it is instructive to look at the control group trends. For water use variables, the trend should logically be expected to be close to zero in 'never access' localities, whereas the observed trends in the heterogeneous control group that was used is close to zero in most cases as well. In cases where the trend is larger than zero one would expect that the impact of first-time access is underestimated, i.e. the estimate can be seen as a lower bound.

Starting with the impact of 'all interventions', the increase between 2009 and 2010 in the use of a modern water point as the main drinking water source in localities that received a new water point is much larger than in control localities: the increases are 32 and 2 percentage points, respectively (see third column labelled 'Difference'). The difference between these changes is the double difference (DD) impact estimate, i.e. the effect of a newly installed water point, and in this case a 30 percentage point increase. At baseline,

52% of households use an improved water point as their main water source in treatment localities so that the relative increase in the use of an improved water source due to the water programme is 58% (30/52). For localities that receive their first improved water point the effect is a 74 percentage point increase in households using an improved water source.[53]

Hence the use of improved sources is not self-evident or automatic when such a source is available in the locality and a non-negligible share of households do not choose the improved source as main water source, although the installation of such a source does increase that share. The survey data provide information on the reasons given by households for not using an improved source even though it is present. The question in particular asks of households who do not use a public tap or a pump what the distance is to the nearest tap or pump. Of those living within a distance of two kilometres, the three most frequently cited reasons are 'it is too far' (35%), 'it is too expensive' (17%) and 'water point interrupted' (13%). Among those households living in a locality where a water point (in most cases a public tap or pump) has been installed less than four years ago, the most cited reasons for non-use of this new source are 'it is too far away' (55%), 'we are used to another source ' (24%) and 'it is too expensive' (23%).

Table 7: Effect of water intervention on use of improved water

	Outcome: household's main source is improved					
	All interventions			First-time access		
	2009	2010	Difference	2009	2010	Difference
Control (%)	62	64	2	62	64	2
Treatment (%)	52	84	32	0	76	76
Double difference			**30**			**74**
P-value (regression)			<0.01[54]			<0.01
Observations			3972			2817

Regression analysis gives very similar estimates but provides a number of additional insights.[55] Regression analysis allows controlling for as well as analysing a number of observed household characteristics that have an impact on the effectiveness of water interventions. The conducted regression shows that wealthier households are more likely to use an improved water source. A relevant question is whether wealthier households are

[53] Note that the number of observations is lower for first-time access. The reason for this is that those localities (households) receiving a second (third, fourth, etc.) improved source in 2009 have been left out of the control group. This is done in all subsequent analyses.

[54] In cases where the P-value was smaller than 0.01 (1%) and hence the estimated impact significantly different from 0 (see also footnote 52), the exact P-value was replaced by <0.01 for matters of simplicity.Regression results are not tabulated but described; tables are available on request. Stata's survey regression (with clustered standard errors) is applied unless stated otherwise. If the outcome variable is binary, logistic regressions are used.

[55] Regression results are not tabulated but described; tables are available on request. Stata's survey regression (with clustered standard errors) is applied unless stated otherwise. If the outcome variable is binary, logistic regressions are used.

also more likely to take advantage of an additional improved water source in 2009. The results do not show such an effect: Although poor households[56] are less likely to use any improved source in general, they do not use the newly installed water points more or less than non-poor households. Moreover, households with infants (less than 1 year old) are a bit more likely to use an improved source while ethnic Peulh (semi-nomadic ethnic group in the central and northern parts of Benin) households are much less likely to use it.

Alternative sources and rainy season

Evaluation question 9: *Is the newly installed water source also used during the rainy season? Is there a reduction in the use of traditional and unsafe sources?*

The effects of a new water source on the use of improved water sources in the rainy season (+26% for general access and +66% for first-time access) are very similar to the dry season impact. Rainwater is the main drinking water source for 33% of households during the rainy season and an additional 38% of households use rainwater as an alternative water source during the rainy season. During the dry season, no household reported to use rainwater as its main water source. There is also a positive effect of an improved water source on the exclusive use of safe sources; however, most households continue to use their 'old' and often unsafe source as an alternative after an improved source has been installed.

A considerable share of households indicates using an alternative source (30% over both survey years), which is often an unimproved water source. One would expect that the quality of the water consumed improves particularly in case households switch to an improved source (from an unimproved source) without continuing to use an alternative (unimproved) source. For this reason, in Table 8 the effect of a new water source on the outcome 'household uses an improved water source only' is estimated and reported.[57]

Table 8: Effect of water intervention on exclusive use of improved water

	Outcome: household uses an improved water source only					
	All interventions			First-time access		
	2009	2010	Difference	2009	2010	Difference
Control (%)	47	52	5	47	52	5
Treatment (%)	42	63	21	0	51	51
Double difference			**16**			**46**
P-value (regression)			0.02			<0.01
Observations			3972			2817

[56] Throughout this study, poor households are defined as those belonging to the bottom two wealth quintiles (based on asset ownership/PCA) at the baseline.

[57] This information is based on the maximum of two water sources that are asked for in the household questionnaire.

The effect estimate is positive, indicating that the installation of an improved water source results in an increase in the proportion of the population whose source of drinking water is exclusively improved by 16 percentage points. The improvement for first-time access localities is 46 percentage points. Hence, the locality level provision of improved water sources also results in an increase in the exclusive use of safe water sources by households but the impact on the exclusive use of safe source water is considerably lower than on non-exclusive use. The reason is that the probability that households use an unimproved alternative source increases with the installation of a modern water point. This happens, for example, when a household that was using an unimproved main source switches to an improved main source after installation but continues using the unimproved source as an alternative source. In other words, the unimproved alternative source is not newly adopted but relabelled as an alternative source after the adoption of the improved water point as a main source. This is important as regards health effects: Mixing water from improved and unimproved sources will reduce water quality and hence also health benefits.

Water use behaviour is not only influenced by alternative water sources but also by seasonal effects, which in turn leads to differences in the impact of water infrastructure on water use, depending on the season.[58] There is a profound influence of the rainy season on the choice of water source. Rainwater is the main drinking water source for 33% of households during the rainy season and an additional 38% of households use rainwater as an alternative water source during the rainy season. Hence, in total 71% of households reported using rainwater during the rainy season for drinking purposes. During the dry season no household reported using rainwater as its main water source.[59] The increased use of rainwater during the rainy season implies a reduced usage of both, non-improved and improved (excluding rainwater), water sources during this season in comparison to the dry season, both as a main and an alternative water source.

Table 9 shows the results of the double difference estimate, analysing the impact of a newly installed water source on the use of an improved water source[60] during the rainy season. The use of an improved water point as the main drinking water source during the rainy season increases by 26 percentage points for all interventions, and by 66 percentage points for first-time access. These effects are somewhat lower than for the dry season. Note that a simple before–after analysis of treatment localities would have led to an overestimation of the impact of water installation on improved water use (41 percentage points). The reason is that there was much less rain during the rainy season in July 2010 in comparison to 2009 so households in general used more improved sources during the rainy season in 2010 than in 2009.

58 For this reason this impact study conducted two rainy season surveys (before and after the water interventions in 2009) in addition to the main baseline and follow-up survey conducted during the dry season in 2009 and 2010. Data for the rainy season were, however, only collected for the subsample of Collines (see discussion in Section 3.1).

59 Rainwater can only be collected if the household has a roof made of corrugated iron. Some 72% of households indicated having such a roof, so the number of rainwater users seems plausible.

60 Note that, in accordance with previous analyses, rainwater is not included in the definition of an improved source.

Table 9: Rainy season: Effect of water intervention on use of improved water source						
	Outcome: household's main source is improved					
	All interventions			First-time access		
	2009	2010	Difference	2009	2010	Difference
Control (%)	26	41	15	26	41	15
Treatment (%)	25	66	41	0	81	81
Double difference			**26**			**66**
P-value (regression)			0.03			<0.01
Observations			1,984			1,350

Source: Household data, rainy season, Collines, 2009-2010

3.4 Water quantity and quality

Water quantity

Evaluation question 10: *What has been the change in the quantity of water consumed? Are there differences across socio-economic groups with regard to the quantity of water consumed?*

There is a large increase in the quantity of water collected by households from an improved water source of 9 litres per capita per day from a baseline of 18 litres. In case of first-time access, this impact is 23 litres per capita per day. The quantity of total water collected, irrespective of source quality, increases by only 7 litres per capita per day from a baseline of 30 litres. Although poorer and larger households consume on average 4 litres per capita fewer than wealthier and smaller households, there is no evidence that the analysed water interventions have a different effect on the change in quantity consumed by the poorer or larger households.

Water quantities are calculated using households' estimates of the number of water containers (*bassines*) collected from the two main water sources of the household in combination with an estimate of the total capacity of the container. It should be emphasized that the quantities here are totals collected and these are not necessarily fully used for consumption purposes.[61] Also note that any water that is used at the water points themselves (e.g. for bathing and washing clothes) but not collected in the *bassine* has not been accounted for here.

[61] It is assumed that the container size does not change between the two surveys and that 90% of the container volume is effectively used, with 10% of the capacity not filled at source or lost due to spillage. Note that quantities above the 95th percentile are omitted to reduce the influence of outliers.

Watermeter

Table 10 presents the impact on the quantity of water collected by the household from an improved source, including both water used for drinking and for other purposes such as cooking, washing and hygiene. The data show very little change for the control households and a considerable increase in water quantity from a safe source for the households in localities where an improved water source was installed. For general treatment (left side panel of Table 10) plus 9 litres per capita per day are found. For first-time treatment, the changes add up to a double difference of plus 23 litres per capita per day. Hence, the relative quantity effects for water from an improved source are sizable: plus 50% in general and about 100% (relative to the control group baseline mean) in case of first-time access.

The impact on quantity of all types of water (both from improved and unimproved sources) is, as expected, much smaller at plus 7 litres per capita per day from a baseline of about 30 litres. Hence a newly installed water source does not greatly increase total water quantity collected, but mainly the quantity collected from an improved water source. The estimates also show that the total water quantity collected is increased in two ways: through a slightly increased quantity collected from the newly adopted improved main source and through the continued use of a traditional water point as an alternative source.

Table 10: Effect of water intervention on water quantity						
	Outcome: litres per capita per day obtained from improved sources					
	All interventions			First-time access		
	2009	2010	Difference	2009	2010	Difference
Control (lit)	19	18	-1	19	18	-1
Treatment (lit)	16	24	8	0	22	22
Double difference			**9**			**23**
P-value (regression)			<0.01			<0.01
Observations			3786			2682

Last, poor households collect significantly less water (4 litres fewer per capita per day) than non-poor households. Also, larger households and households with children under the age of five have lower per capita water consumption. However, there is no evidence that the change in water consumption caused by the analysed water interventions is different for poorer or larger households.

Water Quality

Evaluation question 11: *What has been the change in the quality of water at source and at point of use?*
The installation of a new water point significantly improves the microbiological quality (i.e. reduces E. coli contamination) of the main water source used by the households of a locality. This impact is especially large in localities that receive an improved water source for the first time. The installation of a new water point also has a positive impact on households' perceptions of the quality of the water from their main source. There is no evidence that water point installation as a standalone treatment reduces E. coli contamination at point of use, i.e. at the household level. However, the distribution of new and improved water transport and storage containers is highly effective in this respect.

E. coli is a bacterium that is commonly found in the gut of humans. Most strains are harmless, but some can cause severe infections with abdominal cramps and diarrhoea being the most often observed symptoms. The presence of E. coli bacteria in water indicates (recent) contamination with human or animal faeces and is widely used as an indicator of general bacteriological contamination of water. If water is polluted, usually a very high number of E. coli bacteria is found. The WHO defines the maximum acceptable concentration of E. coli in water intended for drinking purposes at zero (WHO-UNICEF, 2008). For this study, a cut-off of 1000 E. coli per ml was chosen as a threshold for contamination. Several studies have shown that in sub-tropical regions a correlation between diarrhoea and E. coli can only be found at higher contamination levels. A binary variable of high E. coli contamination (yes or no) is therefore used as the primary indicator of water quality in this analysis. Note, however, that E. coli bacteria do not provide directly any information about the health status of the household members, as improved water quality is only one of the faecal–oral pathways and other contamination – hands and food – might indeed be equally important. Moreover the absence of E. coli is only an indication

Traditional well

for the absence of faecal contamination, but bacteria and viruses other than E. coli may also cause diarrhoea (WHO-UNICEF, 2008).

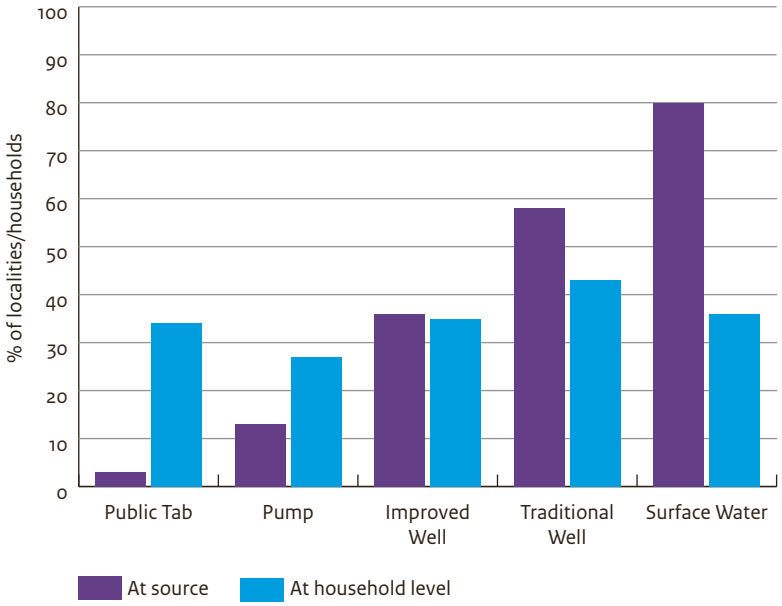
E. coli tests have been conducted for both the water at point of source and the water stored within the households. Figure 8 presents E. coli contamination incidence as measured at the water sources of the localities and as measured at the household storage container level by type of (main) source.

Figure 8 shows that, at source, the water from an improved source displays E. coli contamination much less frequently than water from a traditional water source. The estimates furthermore confirm a finding from previous water quality studies: when improved water quality is provided through a public water point, levels of E. coli contamination are generally still quite high at point of use, and much higher than at point of source (e.g. Wright *et al.*, 2004).

Woman drinking water from cup

The difference between source and point-of-use contamination levels for improved sources has several causes. First, note that public water provision 'forces' households to store water within their household for consumption. Hence, one possibility is the recontamination of water during transport and storage. In particular, the widespread custom of using a cup to take water from the household storage container generally means touching the water with the hand. This introduces a possible pathway for oral–faecal transmission of pathogens. Another possibility is that household storage containers may contain water from a mix of water sources so that, even when households report that their main drinking water source is improved, an alternative traditional source may contaminate the water at point of use. A combination of these factors applies to other cases. Hence, whereas the differences in water quality between improved sources (mainly public taps and manual pumps) and unimproved sources are large, there are no differences of the water quality originating from these source groups at the household level.

Figure 8: *E. coli by water source*



Source: Locality and household data, 2009-2010

Interestingly, surface water shows (statistically significant) higher contamination at source than at household level. One reason might be that here mixing (with improved sources) causes better quality.[62] Another reason is that households use point-of-use treatment, such as boiling or chlorine, to improve the quality of water from traditional sources. Point-of-use treatment is infrequent for improved water sources – at about 1.5% – but is often applied among users of traditional sources (40% for surface water!). However, it is not clear exactly when treatment takes place (before storage or before drinking).

Table 11 presents double difference estimates for the impact of an improved water source on E. coli contamination of the main water source used by the locality (as indicated by the locality chief).[63] The results clearly indicate that the installation of a new water point provides access to cleaner water at the locality level. This impact is especially large in localities that receive an improved water source for the first time. Here E. coli incidence decreases from 68% to zero. Over all interventions, E. coli at the point of source decreases by 29 percentage points if a new water source is built.

[62] It is also likely that the surface source water tested is from a different source than the surface water actually used by households but this does not necessarily result in lower measured contamination.

[63] Note that the water test data come from a sub-sample of 140 localities randomly chosen from the total of 200.

Table 11: Effect of a new water source on E. coli at point of source[64]						
	Outcome: water from main locality water source contains E. coli					
	All interventions			First-time access		
	2009	2010	Difference	2009	2010	Difference
Control (%)	36	33	-3	36	33	-3
Treatment (%)	37	5	-32	68	0	-68
Double difference			**-29**			**-65**
P-value (regression)			<0.01			<0.01
Observations			268			187

These water source level results are confirmed by households' perception of changes in water quality. Households were asked to rank the quality of the water from their main drinking water source on a 4 point scale from 'very good quality' to 'bad quality'. When a double difference analysis of water supply on households perceived water quality at source (with the 'bad quality' indicator (yes = 1, no = 0) as the outcome variable; results not tabulated) is conducted, the same results as in Table 11 are obtained: a slight drop in the control group versus a large drop in the intervention group and a larger impact for the first-time access intervention.

Before analysing E. coli incidence at households' storage containers (i.e. water at point of use) it should be noted that a second type of intervention – aimed at improving the water quality stored in the households – took place, which has to be included in this analysis. During 2009, i.e. at the same time as new water points were built in some localities, out of the 200 localities studied, 37 localities that were already using an improved water source at baseline received a 'storage treatment': households were supplied with: (a) a clay or plastic storage container with a lid and a spigot (tap) at the bottom, allowing water to be consumed without touching the water; (b) a jerrycan (bidon) with a small mouth for transporting the water from the source to the storage container; and (c) a brief instruction on the use of these items, particularly on the importance of not touching the water. Apart from the distribution of the storage and transport containers and the instruction, households in treatment localities were not treated differently from other sampled households.

The question analysed is therefore whether the installation of improved water points has an impact on household-level E. coli contamination, taking into account the storage treatment in some of the localities. To answer this question a double difference regression, analysing both treatments separately and the combination of both, is performed. The regression contains dummies for each group of the intervention combination (water only, storage only, water and storage combined), a time trend and a combination of time trends and each intervention group.

[64] The maximum number of observations in the locality water test sub sample is 280. The actual number in this table is 268 localities, i.e. in some cases water test results for the locality main source could not be obtained.

Water storage experiment

The regression output for the relevant policy variables is presented in Table 12 and leads to the following conclusions: Only in localities where improved water storage containers were distributed is a significant drop in E. coli contamination observed. This effect is highly significant and large: minus 23 percentage points on average, or, with an overall mean contamination level with E. coli of 30%, a relative reduction of more than 70%. Locality level water point provision without storage container provision does not have a significant effect on household-level E. coli contamination. The effect of a first-time water access on E. coli contamination is also zero.

Note that the measured E. coli effects of the water storage intervention have been measured only three months after the new storage containers were taken into use by households. Hence, at least so far, one can only measure the short-term effects of storage interventions, which represent at least two separate effects: one is the effect of introducing a new, clean container without E. coli traces from previously stored water. This effect should also be obtained from distributing new storage containers without a spigot. More interesting from a policy perspective is, however, the effect of the spigot in the long-term, an analysis which is scheduled to be done in 2011-2012.

Water storage experiment

Table 12: Effect of a new water source and new storage container on E. coli at point of use[65]

VARIABLES	>0 E. coli per 100 ml in household storage	
	Coefficient	Standard errors
Year 2010	-0.0930**	0.0393
Installation of improved water source	0.0114	0.0645
Use of new water storage container	-0.233***	0.0333
Improved water source AND new water storage container	-0.210***	0.0484
R2	0.05	
Observations	2,485	

*Notes:***significant at 1% level, **significant at 5% level, *significant at 10% level. Controlled for group effects (not shown in table). Note that the number of observations in this table is smaller than for most other tables as E. coli testing was not done for all households.*

[65] The maximum number of observations in the household water test sub-sample is 2800. The actual number is 2485 households. The difference of close to 9% is because of field logistics.

Water and sanitation complementarities

Evaluation question 12: *Is the impact of water enhanced by sanitation interventions and hygiene education?*

There is no evidence that hygiene training has an impact on reduction of point-of-use E. coli contamination. There is also no evidence of complementarities between water and hygiene treatment to improve water quality – that is, the effect of water point installation on water quality is not enhanced by hygiene education.

A set of regressions (not reported here) analysed the three main hygiene interventions (hygiene promotion by community health worker, reported project-based hygiene promotion, and public latrine building). In those cases where hygiene was provided as a 'standalone' treatment or combined with a new water point, no significant impact on E. coli contamination was found. In other words, no evidence could be found for complementarities between water and hygiene treatment.

On theoretical grounds there is of course a good case for complementarities between water and hygiene treatment and their impact on water quality. Both hygiene knowledge and ample availability of clean water are required to change hygiene behaviour. And both hygiene behaviour and clean water sources are required to consume water that is not contaminated with E. coli. Nevertheless, the evidence on water-hygiene complementarities provided in the literature is not encouraging (e.g. WB–IEG, 2008). Our study also suggests the absence of these complementarities. It is, however, unclear if there would be complementarities if hygiene promotion would be delivered in a more effective way, by significantly changing the hygiene behaviour of households (see also Section 3.6).

Rainy season and water quantity and quality

Evaluation question 13: *Are there any seasonal differences in the impact of interventions on water quantity and quality?*

There is no impact of installing an improved water point on the total water quantity collected during the rainy season (neither in general nor in the case of a first improved water point). This is different from the results for the dry season where an increase in the water quantity consumed can be observed. The impact of improved water access and/or improved water storage on water quality at point of use during the rainy season is similar to the dry season. No effect of an improved water source in general, but a large effect of improved water storage. But first-time improved water access significantly improves water quality during the rainy season, whereas this is not the case during the dry season.

Table 13 presents some descriptive statistics on the quantity and quality of drinking water during the rainy season 2010. Column 1 shows that rainwater is used as the main source by many but not by the majority of households during the rainy season. Use of an improved water point as the main drinking water source is about 50%, i.e., higher than rainwater and non-improved sources, but lower than during the dry season. Column 2 also presents

quantity of water consumed per person per day for each category of main water source.[66] Households that indicate using an improved water point as their main drinking water source report higher quantities consumed by household members. One reason is that the households that use an improved water source are more likely than those only using an unimproved water source (or rainwater) to use a secondary (unimproved or rainwater) water source (see Section 3.3). This is confirmed by column 3, which shows that 33% of the water consumed by households that use an improved water source as their first water source is indeed rainwater. Households that use rainwater as their main water source, only consume rainwater. A second reason is that if the household uses rainwater as its main water source, water supply is much more fluctuating and less reliable than from an improved water source, which sometimes leads to constraints in the quantity consumed. In general, the water quantity consumed per capita per day is, as expected, higher in the rainy than in the dry season.

Table 13: Rainy season: Water use and E. coli

	Use as main source	Total quantity	Rainwater share	E. coli positive
	(% of households)	(litres per capita per day)	(% of total water consumption)	% households
Improved source	51	54	33	27
Rainwater	33	39	100	30
Non-improved source	16	44	15	50
All	100	47	52	32
Observations	993	916	915	655

Finally, the last column of Table 13 shows that both improved water sources and rainwater have an E. coli contamination incidence of about 30%, while stored water from non-improved water sources has an E. coli incidence of 50%. This indicates that rainwater can indeed be considered as 'safe' as water from an improved source as defined by the WHO-UNICEF Joint Monitoring Programme on Water and Sanitation.

For the analysis of the impact of an improved water source on the **quantity** collected, the focus is on non-rainwater quantity (thus avoiding rainwater measurement problems)[67] and on **quality** of water stored in the household. Results do not show any statistically significant impact of installing an improved water point on the total water quantity (both main and alternative source) collected during the rainy season, neither when this is an additional water point nor when this is the first improved water point. Apparently the widespread availability and use of rainwater during the rainy season dilutes any quantity effects observed from additional water points during the dry season.

66 A caveat is that levels of rainwater collection are notoriously hard to measure.

67 The results are, however, not much different if rainwater is included in the analysis.

The analysis of the dry season data showed that a new water point did improve the water quality at source (in terms of E. coli contamination) but no effect was found at point of use. A slightly different result is obtained for water quality at point of use during the rainy season. There is no impact on E. coli contamination when a new water point was installed in general. However, in case of first-time access to an improved water point one finds that water point provision causes a significant reduction of the percentage of households that store water contaminated with E. coli (see Table 14).

Both the zero effect for the 'general' water point treatment and the significant negative effect for the first-time access treatment are robust to changes in specification. A possible first explanation for this result comes from the last column of Table 13, which showed that water obtained from traditional sources is more often contaminated in the rainy season than during the dry season. It is thus to be expected that the installation of an improved source has a higher impact in this case, especially when there is no improved alternative yet. Another possibility is that the danger of recontamination is less severe during the rainy season: for example, mixing of water from an improved source in the household storage container is more likely to be with rainwater which is of general good quality. Therefore, the good water quality obtained at source is preserved more often during storage within the households.

Table 14: Rainy season: Effect of water intervention on E. coli at point of use

	Outcome: water in household storage contains E. coli					
	All interventions			First-time access		
	2009	2010	Difference	2009	2010	Difference
Control (%)	56	34	-22	56	34	-22
Treatment (%)	50	29	-21	61	14	-47
Double difference			**1**			**-25**
P-value (regression)			0.98			<0.01
Observations			1,313			831

3.5 Water distance, time and time use

Evaluation question 14: *What has been the change in the distance and time used for the collection of water?*
A newly installed water source decreases the distance from households to their main water source by about 100 to 230 metres. The percentage of households that have to walk less than 200 metres to the main water source increases by about 30 percentage points (equal to 100%) if a new water point (if the first improved water point) is installed. With the installation of a new water point, households save on average 15 minutes collecting one container of water. In cases where the first water source is built in the locality the average time for a round trip is reduced by 20 minutes. No time savings are found for the rainy season. Furthermore, queuing is an important factor when considering reductions in time for water collection. Queuing takes up about 50% of the total water collection process and is obviously dependent on the number of households per improved water source. Hence, the time savings achieved in smaller

localities are much larger (22 minutes) than the time savings achieved in larger localities (time savings of only 7 minutes per round trip).

Distance

In this section first the effect of a newly installed water point on the distance people have to walk is evaluated, followed by an analysis of the time people need for water collection per round trip and per day. Table 15 shows that in 2009, about 45% of the households in the control and in the treatment localities used a water source that was less than 200 m away from the household (self-reported). In 2010, after a new water source was installed, this percentage increased significantly for the treatment group to 60% of households, but not for the control group. A newly built water point hence increases the share of households that collect their water within 200 m of their house by 15 percentage points or about 30%.[68] For localities which received the first modern water point the effect is much stronger, with an increase in households using a water point within a 200 m distance by 28 percentage points, doubling the share of households that collect their water within 200 metres.

Table 15: Effect of water intervention on distance (self-reported)

	Outcome: households using a source within 200 m distance (in %)					
	All interventions			First-time access		
	2009	2010	Difference	2009	2010	Difference
Control (%)	45	47	2	45	47	2
Treatment (%)	43	60	17	31	61	30
Double difference			**15**			**28**
P-value (regression)			0.01			<0.01
Observations			3,688			2,596

In 2010, also GPS data for each water source within a village was collected, which allows the exact distance between households and their main water source to be calculated.[69] This information is not available for 2009. In 2010, households that were living in a locality that received an improved water point during the last year were on average 100 m closer to their main water point than households living in a locality that did not receive an (additional) improved water point (Table 16). Given that the self-reported distance for control and treatment group is quite similar in 2009 (see Table 15), it seems that the construction of a new water point 'brings' the main water source considerably closer to the household.

[68] Note that some households might decide not to use the new water source (see Section 3.3). They enter in the calculation with a reduction of 0 metres.

[69] The number of observations goes down from 1961 to 1527 because households using a small traditional private well (with 0 m distance to the household) not listed as public were excluded and because of some GPS data errors.

Table 16: Distance in metres to main water source in 2010						
	All interventions			First-time access		
	Control	Treatment	Single Difference	Control	Treatment	Single Difference
Mean (in m)	470	368	**102**	587	358	**229***
% of households > 1000m	8.45	3.37	**5.08 ****	9.47	4.37	**5.10****

*Notes: ** significant at 5%, *significant at 10%*

The difference in 'distance to the main water source' between households living in a locality with a first improved water source and households living within a locality without any improved water source is about 230 m (Table 16).[70]

Time savings

In a next step, the time savings related to the measured reductions in distance are analysed.[71] Table 17 shows that before the intervention households in control and treatment localities needed approximately the same time for walking to their water point, collecting water, and returning home (30 minutes on average). A new water point reduces the time needed to collect one container of water by 14 minutes; and in case of first-time water access, the reduction increases to 21 minutes. Note that these are averages which also include households that decided not to switch to a new water point (Section 3.3). When directly asking those households in 2010 that had recently received new water points in their locality, whether they think that the time to collect water has been reduced for them because of the new water source, 30% answered that they do not use the new water point, 15% answered that there was no change in time, 24% answered that the time to collect water reduced a bit, and 30% reported that the time to collect water has been reduced considerably.

Table 17 also shows that the average time to collect water has in general increased over time. The main reason for this increase (for both control and treatment localities) is the much larger attention given to the time question by the enumerators in 2010.[72] This has increased the measured collection time across all observations, but should not be correlated with treatment.[73]

[70] Note that this distance is likely to be a lower bound estimate, given that (according to Table 14) in 2009 households living in localities with no previous water access were further away from their main water point than households living in control localities.

[71] Note that, in general, measuring the time a household needs to fetch water is difficult in a developing country setting as it is prone to high measurement errors: exact timing often plays a minor role in the daily lives of the rural population in Benin.

[72] In 2010, the exact same question for the round-trip time was posed but some questions were added to measure duration of parts of the water fetching process (walking, waiting in line, chatting; see other tables). It is possible that enumerators introduced the question in such a way that respondents started thinking about the parts of the trip. Asking more detailed questions is known to increase mean values.

[73] The same enumerators interviewed both control and treatment localities and enumerators were not aware of the fact whether a locality constituted a control or treatment locality.

Analysing the impact of the installation of an improved water source on collection times during the rainy season yields no significant results, either for 'all interventions' or for 'first-time access'. The reason is that households also use rainwater during the rainy season (see Section 3.4) and collect less water from community water sources during these months. First of all, this leads to less 'population pressure' for other improved and unimproved water sources, leading to lower queuing times during the rainy season in general. Secondly, households using rainwater for drinking purposes during the rainy season basically have a distance of 0 metres to their water source. The time needed to collect water during the rainy season is, therefore, also on average about 50% lower than during the dry season.

Table 17: Effect of water intervention on collection time for one container

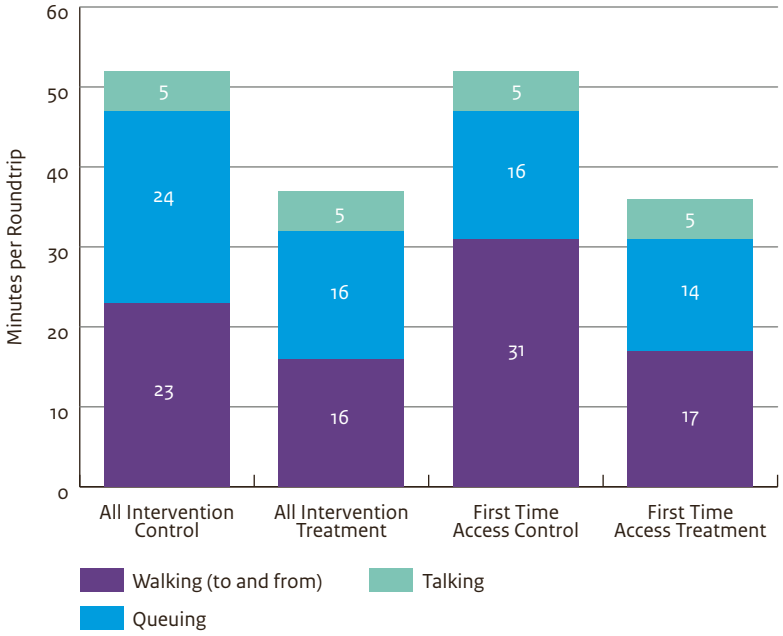
	Outcome: collection time for a round trip (in min)					
	All interventions			First-time access		
	2009	2010	Difference	2009	2010	Difference
Control (in min)	29	51	22	29	51	22
Treatment (in min)	30	38	8	34	35	1
Double difference			**14**			**21**
P-value (regression)			<0.01			0.01
Observations			3,688			2,596

Queuing and locality size

Comparing Table 17 with Table 16, it becomes clear that a 100-metre reduction in distance to the main water source does not explain the large time savings of about 15 minutes per round trip: this would imply that people take 75 minutes to walk one kilometre. Therefore the water collection process has been analysed in more detail in 2010 (Figure 9).[74] The process is divided into the time spent walking to the water source, the time spent waiting in a queue at the water source, and the time spent talking to other people at the water point (after standing in line).

[74] Double difference analysis is not possible here as this information was only collected in 2010. However, given that the total time spent collecting water was estimated to be equal between the control group and the treatment group in 2009, one can assume that there was also little difference in the time needed for various components of the water collection process before the water intervention.

Figure 9: *Water collection process composition*



As shown in Figure 9, it seems that an important determinant of the time for a round trip is how long the person has to wait in line. Apart from reducing the distance, a newly installed water source also reduces the 'population pressure' on the existing (as well as the new) water source. In total, the control group – who did not receive a new water point – reports taking 15 minutes longer to collect one container of water in 2010, of which 8 minutes are spent standing in line at the water point and only about 7 minutes longer are needed to reach the water source. In contrast, for first-time access the distance is the decisive factor and queuing time is only reduced marginally. Moreover, Figure 9 also indicates that a large share of collection time is spent on standing in line for the improved water source (equal to the time used for walking to the water source and returning). This is not the case for, e.g., surface water, where people report staying in line for only about three minutes.

No difference is found between treatment and control groups with regard to talking to friends at the water source (after standing in line and receiving the water). This is clearly a time use that should not be influenced by a new water source and one would not expect to find a treatment effect here. This supports the attribution of the observed changes to the interventions and not to some other factor or trend.

Given that queuing should largely be affected by locality size, it was also estimated whether the time impact of an improved water source is larger for smaller localities (Table 18).[75]

[75] Small localities are defined as localities with a size of smaller than 50 households (the mean is 81 households per locality).

The difference is considerable. Whereas in small localities a new water source decreases the time taken to collect one container of water by 22 minutes on average, this difference is only 7 minutes for larger localities.

Table 18: Effect of water intervention on time for round trip (self-reported)

	Outcome: collection time for round trip to the water source (in min)					
	Large localities			Small localities		
	2009	2010	Difference	2009	2010	Difference
Control (in min)	27	50	23	31	53	23
Treatment (in min)	24	40	16	35	36	1
Double difference			**7**			**22**
P-value (regression)			0.03			<0.01
Observations			2,147			1,541

Evaluation question 15: *Who collects water and who benefits most from time savings? Can an increase in school enrolment and/or attendance be observed and has saved time been used for more economic activities?*
Some 80% of individuals engaged in water fetching are women. Every third (fifth) household sends a girl (boy) below the age of 16 to collect water. Mixed results for the impact of a newly installed water point on schooling enrolment rates were found. Whereas no effect on the share of girls (or boys) of a household enrolled in school was found, at the school level the number of enrolled girls increased by about 20% if a new water source was built, but only for the case of Mono-Couffo. Only 35% of households report that they use the time gained from water collection for economic activities. Multiplying this result with (a) the average number of hours (days) saved per year per household with a newly installed water source, and (b) the daily wage in Benin, we estimate that an average household's income could increase by about 0.7% with the time savings from an additional water source.

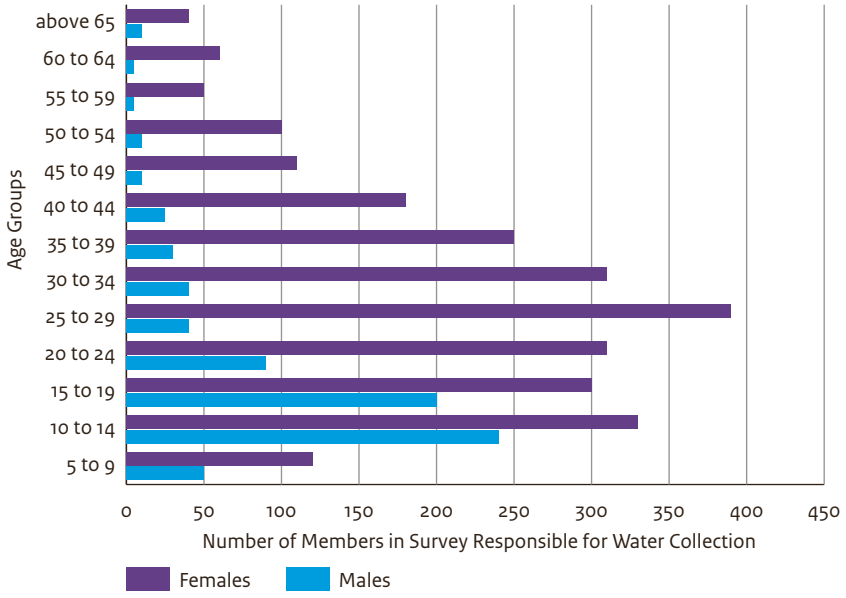
Labour allocation of water collection

Calculations show that, on average, 1.65, or in other words one or two, household members are in charge of collecting water. The burden of water collection is, hence, not shared equally among household members (on average we find 6.3 household members per household). In 2010, in each household on average one adult female is responsible for water collection. In 28% of households a girl is responsible for water collection in addition to the adult female. In 'only' 17% of households is a man and/or a boy responsible for water collection (adults are defined as individuals above the age of 15). This means that women are more than five times as likely to be responsible for water collection as men. For children, the gender inequality is much lower, and girls are only twice as likely to be responsible for water collection as boys. In total, about 80% of individuals engaged in collecting water are female.

Figure 10 further shows that already at a very young age children have to help their parents with fetching water. In general, it is mostly females between the age of 10 and 35 who are in

charge of water collection. Men seem to be more engaged in water fetching activities at a younger age (between 10 and 20) but in general also less than females in the same age group.

Figure 10: *Age structure of persons responsible for water collection*



The impact of a newly installed water point on the number of household members occupied with water collection is addressed next. This question is analysed separately for age and gender groups, as well as separately for 'all interventions', 'first-time-access', and Mono-Couffo and Collines. Table 19 shows an overview of these estimations.

Table 19: Effect of water intervention on persons responsible for water collection

Outcome variable	All interventions (both regions)	First-time access	Collines (all interventions)	Mono-Couffo (all interventions)
Total number of household members collecting water	NO	NO	NO	NO
Female age <= 16 collecting water	NO	NO	NO	YES (reduction)
Male age <= 16 collecting water	NO	NO	NO	NO
Female age > 16 collecting water	NO	NO	NO	NO
Male age > 16 collecting water	NO	NO	NO	NO

It is estimated that an improved water source (both general and first-time access) does not have any impact on the number of household members occupied with water collection. Note that, in general, only a few household members are occupied with water collection anyway. Only a new improved water point in Mono seems to have an effect on the females below the age of 16 that are totally 'freed' from collecting water: Households in a locality that receives access to a new water point in Mono decrease the number of girls engaged in water collection by 13 percentage points: Whereas 30% of households engaged a girl in water collection before an improved water source was installed, this rate dropped to 17% after the installation of a water source. This reduction implies a relative decrease of more than 30%. This means that if time savings are achieved, girls seem to benefit most in terms of being totally 'excused' from water collection – at least for the case of Mono. Note that this phenomenon is not caused by higher time savings in Mono, where the time necessary to collect water is not reduced more by an improved water source than in Collines (results not shown).

Time savings and schooling

The question how the water collection time saved is spent is addressed next. This issue is highly relevant for development policy since it could affect the gender balance within households and positively affect investment in human capital, especially in the form of better education for girls. Even though the analysis finds girls 'freed' from water collection in Mono, and even though in general considerable time gains are achieved with the installation of an improved water point, the results with regard to school enrolment rates are mixed. At the household level, there is no evidence of an increased share of children, or girls, at school age being sent to school by their parents if a new water point is installed. This is true for different age ranges and schooling levels and regions. This does, however, not necessarily mean that attendance rates have not increased. Even though this question is difficult to assess quantitatively, the survey asked ex post – after the installation of an improved water source – what children previously occupied with water fetching do with the time gained. About 43% of children below the age of 16 that were previously occupied with water fetching reported that they now use the additional time for studying (self-reported). The rest of the children reported that they now do more other work for the household (33 %), or have more free time with friends (remaining 24%).

However, in line with the results of Table 19 schools that host children from treatment localities in Mono-Couffo show an increase of 39 enrolled girls, which is a large effect of 20% more girls in school (see Table 20). No such effect can be found for Collines or for children in general. This finding raises the question why a positive effect is found at the school level but not at the household level. This difference can be explained by much higher precision in the school survey data: first, the school survey provides data on the whole school population (no sampling variance). Secondly, it is likely that there is less reporting error in the school records. The second – unanswered – question remains why we find these effects of 'freed' girls and increasing enrolment rates in Mono-Couffo and not in Collines.

Table 20: Effect of a water intervention on girls' enrolment rates (school level) in Mono-Couffo			
	Outcome: average number of girls enrolled in primary school		
	2009	2010	Difference
Control	165	157	-8
Treatment	189	220	31
Double difference			**39**
P-value (regression)			0.02
Observations			200

Economic value of time savings

The next question addressed is the impact of a water point intervention on income through an increase in economic (income earning) activities. Analysing whether the time gained from a newly installed water point is used for economic (and income generating) activities is difficult for rural settings. First, during a pilot study it seemed impossible for individuals in rural Benin to report the hours they spend per day on various activities. Second, in rural poor areas it is in general very difficult to obtain income estimates from the population. Such an exercise would have largely increased the time necessary for one interview and was not within the scope of the impact study.

For these reasons, the impact on economic activities and income is estimated indirectly. The following approach was followed:

First, households that had recently received a new water point within their locality were asked what type of activity the person usually engaged in water fetching had done with the time gained. For adults, additional housework is most often mentioned as the activity benefitting from reduced water collection time (40% of individuals). Only 35% of adults report using the extra time for productive work (in the fields or for trading). To achieve higher percentages of productive time use by the main time savers (women), might require additional inputs, such as credit for seeds or animals, training, etc. (see also Sijbesma *et al.*, 2009). Second, average time savings per day per household (due to the impact of an improved water source) are calculated. The total time spent per day is measured as the time for one round trip times the number of containers collected per day. The time savings per day amount to 23 minutes for all interventions and 54 minutes for first-time access, which translates into 140 hours (17.5 days[76]) and 329 hours (41 days) of time savings per year and household respectively (Table 21). Third, income gains were approximated with daily rural wages in Benin, which are equivalent to dividing measured household income per year (EMICoV Household Survey, 2007) by number of working days and adult persons per household.

[76] An eight-hour working day is assumed.

Given that a daily rural wage in Benin is about FCFA 1000 (or EUR 1.50), if all time savings would be transferred into economic activities, the average household could gain an additional EUR 26 (EUR 63) per year, which constitutes an increase of about 2% (4.5%) of a rural households' income per year (which is about EUR 1,300 according to the EMICoV Household Survey, 2007). However, given that only about 35% of the time gained from water collection is used for economic activities, an additional manual pump increases the average households' income only by about 0.7% (1.6%) or EUR 9 (EUR 22). Given that there might be a non-linear relationship between time spent on productive activities and income increases these estimates probably present an upper limit of income gains.

Using the average locality size of 81 households, in an average locality the income gained per year from a general (first time) improved water point due to the time savings achieved is hence equal to about 5.8% (9%) of the investment cost for a manual pump.[77]

Table 21: Value of time savings

	Average time savings (in min/hours/days)		'Hypothetical' average value (in FCFA 000/EUR)		'Actual' Average Value (in FCFA 000/EUR)	
		Per year	Per household	Per locality	Per household	Per locality
All interventions	23 min	140 hours 17.5 days	FCFA 17.5 EUR 26	FCFA 1,417 EUR 2,126	FCFA 6 EUR 9	FCFA 496 EUR 756
First-time access	54 min	329 hours 41 days	FCFA 41 EUR 63	FCFA 3,321 EUR 5,063	FCFA 14.3 EUR 22	FCFA 1,162 EUR 1,771

3.6 Sanitation use and hygiene behaviour

Access and use of sanitation

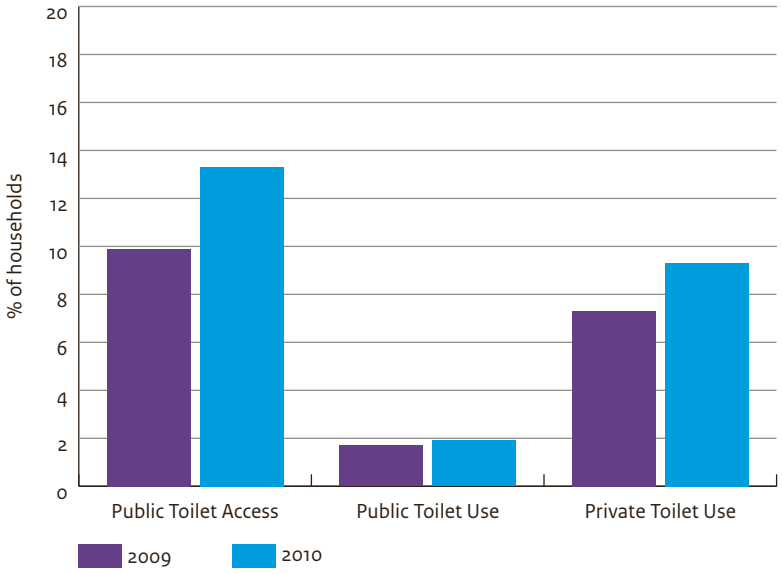
Evaluation question 16: *What has been the change in the access to and use of an improved sanitation facility for the population? Are there differences across socio-economic groups in terms of use?*

In 2009 both access as well as the use of sanitation facilities increased slightly, even though much less than access to and use of improved water sources. Whereas in the long-term it seems that public toilet construction has little impact on toilet use, there is a considerable short-term impact of a new public toilet on the percentage of households using improved sanitation (increase of 13 percentage points). Moreover, especially the poor seem to increase their use of an improved sanitation facility (increase of 30 percentage points). Overall, both the access to and use of sanitation facilities remains very low in Benin.

77 The investment cost for a manual pump is about EUR 13,000 (see Section 3.8).

Both public and private latrine access and use remain very low in rural Benin. Figure 11 shows the percentage of localities where a public (first column) latrine is available, as well as the use of public and private toilets as measured at the household level (second and third column) for 2009 and 2010. The first observation is that there is a large difference between public toilet access and public toilet use. Whereas in 2010, 12% of localities reported a public latrine accessible for the population, only 2% of households actually used a public latrine. Private toilet use was slightly higher, at around 8% of households.[78]

Figure 11: *The percentage of households with toilet access and use*



One can also observe that there is a slight improvement in access to and use of toilets between 2009 and 2010, but this is low in comparison to the improvements achieved in water supply in the same localities. Whereas around 40% of localities received a new water source in 2009, only 3% of localities obtained a new public latrine. Private toilet use also increased slightly by about 2 percentage points (or 25%) over the study period. The question is if this increased use of improved sanitation (private and/or public toilets) was caused by any of the hygiene/sanitation interventions described in Section 3.2: (i) a public latrine was built within the last year; (ii) a project (NGO or governmental) was launched during 2009 on hygiene/sanitation related questions; (iii) a health community worker talked about hygiene related issues within the last year. Neither a health community worker nor a project on hygiene and/or sanitation promotion increased toilet use; only the construction of a public latrine increased toilet use (Table 22).

[78] The figures reflect household level use of latrines, i.e. whether the household uses a private or public latrine in general. No individual information on differences by age or sex was collected, except for children under the age of five whose excrement usually shows the highest load of pathogens.

Table 22: Effect of construction of public latrine on toilet use			
	Outcome: Improved Toilet Use of Households		
	2009	2010	Difference
Control (%)	9	10	1
Treatment (%)	20	34	14
Double difference			13
P-value (regressions)			0.02
Observations			3,995

Whereas in a cross-section (see Figure 11) it seems that public latrine access has little impact on toilet use, the picture is quite different if we take a double difference approach. A latrine built within the last year remarkably increases toilet use by 13 percentage points (Table 22). Given that, in general, toilet use is at about 11% in Benin, this means that a newly built public latrine in rural areas more than doubles toilet use after one year. This difference between short-term and long-term correlation of toilet access and use indicates that toilets are abandoned over time because of a lack in maintenance (cleaning and emptying). Among households that do not use a public latrine, even though a public latrine is accessible within their locality, the most often reported reasons for not using it were that it was too dirty or too smelly, followed by being too far away from the household. Interestingly, analysing whether the construction of a public latrine leads to different effects for the poor and the non-poor, the poor benefit most: for them a public latrine leads to an increase in toilet use of 30 percentage points, whereas the usage rates of wealthier households do not change. Last, latrines were more likely to be built in localities where already a larger share of households was using improved sanitation. Hence, it might be that a latrine intervention is less likely to be successful in localities where very few households use improved sanitation already. Given that very few localities received a new public latrine in 2009, we can, however, not test this hypothesis.

Hygiene promotion and hygiene practices

Evaluation question 17: *What are the hygiene practices of the rural population? What has been the change in hygiene practices?*

Hygiene practices, both with regard to waste and sanitation as well as with regard to water handling, are not widespread in rural Benin. Overall, there was little change within a year, but community workers seem to have some positive effects on safe waste treatment, whereas their influence on water handling seems to be limited.

Latrines in institution

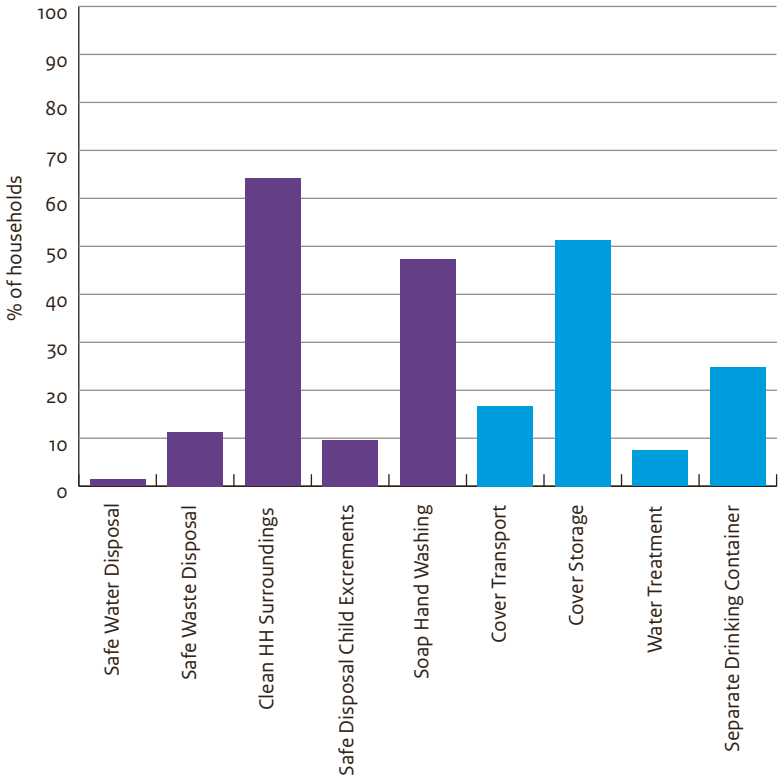
Even though there seems to be a consensus (and even policies) among various organizations that water supply interventions should be followed by hygiene education and latrine promotion, of the localities that received a new water point within the last year, only 10% reported an official project (NGO or governmental) to have started to work on hygiene/ sanitation, and 35% reported that a health community worker started to educate people on hygiene-related questions.

Figure 12 presents evidence on hygiene behaviour with regard to waste and sanitation in 2010 (dark bars). Only 2% (10 %) of households show safe water (waste) disposal practices and do not simply dispose of their water (waste) in their environments. From the observations of the interviewers, only 60% of households had a clean courtyard without any wastes. Only about 10% of households with children under the age of five take proper care of children's excrement and do not leave it in the open. 40% of households reported using soap for hand-washing. Informal observations from the interviewers in the households suggest that this rate should be much lower indicating that households often give socially desired answers when it comes to hygiene behaviour. Hence, all statistics presented in Figure 12 are if anything an overestimation of hygienic behaviour. This effect should, however, not influence the estimates when applying a double difference analysis.

With regard to hygienic water handling (light bars in Figure 12) one finds that, whereas about 50% of households properly cover their water storage container at home, only 20% cover it during transport (excluding branches and plates as unhygienic coverage devises). Only about 25% have a separate water storage container for drinking water. Less than 10% treat their water (e.g. boiling, chlorine) before consumption. Overall, hygienic behaviour

related to water, sanitation, and waste is not widespread in rural Benin and has not changed much during the study period. The figures in Figure 12, which relate to average hygienic behaviour in 2010, are not significantly different from the behaviour observed in 2009 (not shown).

Figure 12: *Hygiene behaviour of households in 2010 (self-reported)*



The issue addressed next is whether sanitation and hygiene interventions had any impact on the observed hygiene practices. For this question 24 double difference regressions have been applied (2 hygiene interventions times 8 hygiene practices as outcome variables) to analyse whether hygiene behaviour was influenced by hygiene/sanitation interventions that took place during the previous year. As hygiene/sanitation interventions we looked at (i) whether the locality leader reported that a project (NGO or governmental) started to work on hygiene related questions, and (ii) whether a community worker talked about hygiene related issues within the last year in the locality.

Table 23: Effect of hygiene promotion on hygiene behaviour		
	Project on hygiene and/or sanitation	**Community worker on hygiene**
Safe waste disposal	YES**	YES**
No waste around household[79]	NO	YES**
Safe disposal of children's excrement	NO	YES ‡
Safe water disposal	NO	NO
Water cover at transport	NO	NO
Water cover at storage	NO	NO
Water treatment (boiling, etc.)	NO	NO
Water container only for drinking	NO	NO

*Notes: **significant at 5% level, *significant at 10% level, ‡significant at 15% level*

In Table 23, the results of these 16 regressions are shown, indicating whether the particular hygiene intervention had an impact on a specific hygiene behaviour. The two hygiene interventions are listed as column headings, the hygiene behaviour outcome variables are listed in the first column. As can be seen from the bottom five rows in Table 23, there seems to be little impact on safe handling of water, irrespective of the intervention type. This either indicates that (i) hygiene promotion with regard to water handling was not done in a way that led to a (sustained) change in hygiene behaviour, or that (ii) hygiene behaviour needs longer interventions (or observation times) to (record any) change, or that (iii) there are other constraints to changing water handling apart from lack of knowledge.

In contrast, safe waste treatment seems to be influenced by both hygiene interventions. The magnitude of impact is a doubling of safe waste disposal and safe child excrement disposal (starting from a low level of 10%, see Figure 12) and an additional 15% of households showing a clean courtyard.

One reason why interventions are more effective with regard to waste handling in comparison to water handling might be (but without any evidence) that treatment of waste is a more observable behaviour than safe handling of water, so social pressure enforces learnt hygiene behaviour. Another reason could be that safe water handling often requires additional investments by households (apart from changing behaviour).

[79] This variable is observed by the interviewers, whereas all other indicators are based on questions asked to the household.

Hygiene and sanitation promotion

Unintended effects: Water interventions and hygiene behaviour

Evaluation question 18: *Have there been positive or negative unintended effects?*
An interesting but worrying negative unintended effect of the installation of improved water points is that households discontinue point-of-use water treatment to improve water quality.

Some households treat their water at point of use – e.g. boiling, filtration, chlorine – in order to make it safer for drinking. Over both survey years the share of households that engage in water treatment is about 10%. As already noted earlier, the percentage is significantly higher for households that primarily rely on wells or surface water, i.e. unimproved water sources. Even though it does not seem that hygiene education changes households' water treatment behaviour (see Table 23) the installation of a new water point indeed leads to households discontinuing treatment of water. This adverse effect is certainly another factor why better water quality at source does not lead to better water quality at point of use.

Table 24 shows that the impact of an improved water source on the percentage of households that treat their water is very large and highly significant. The decrease for all interventions (first-time access) is 13 (20) percentage points which amounts to a reduction of water treatment of almost 100%. The main type of point-of-use treatment indicated during the baseline was the addition of chlorine but the surveys show a large drop in this category. It thus appears that for households water quality from new water points is deemed sufficiently safe and more attractive than water from a traditional source which has been treated with (costly) chlorine.

Table 24: Effect of water intervention on point-of-use water treatment						
	Outcome: household applies water treatment					
	All interventions			First-time access		
	2009	2010	Difference	2009	2010	Difference
Control (%)	7	11	4	7	11	4
Treatment (%)	11	2	-9	19	3	-16
Double difference			**-13**			**-20**
P-value (regression)			<0.01			<0.01
Observations			3,972			2,817

3.7 Impact on health

Water interventions and water-induced diseases

Evaluation question 19: *What have been the effects of water supply on the water related disease incidence of the rural population? Are the effects enhanced by sanitation and hygiene interventions?*

No effects of an improved water point on (self-reported) diarrhoea, vomiting or abdominal pain can be found – even though all of these diseases are highly prevalent in rural Benin, both among children and adults. Only the combination of an improved water source with either improved water storage container or a sanitation project shows a reduction of vomiting by about 50%. It is also shown that a reduction in E. coli contamination of drinking water reduces diarrhoea. In line with Section 3.4, these results show that water quality is indeed important for a reduction of the disease burden in rural Benin, but that an improved water source alone often has little effect on water quality.

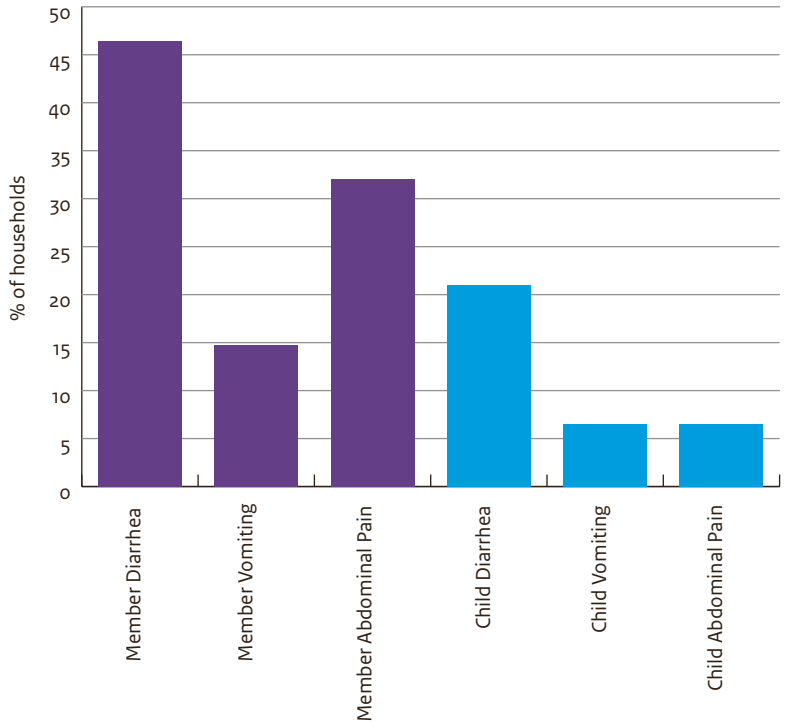
The primary health outcome variables used in this section are self-reported, and indicate, respectively, whether any member or any child under the age of five in the household suffered from diarrhoea, vomiting or abdominal pain within the previous four weeks.[80] Any person and/or child per household with these symptoms – rather than total number of persons and/or children – is used as a measure in order to reduce measurement error of diseases.[81] Diarrhoea, vomiting and abdominal pain are used as health outcomes from a larger list of possible water-induced diseases, given that when households were directly asked what they think was the disease that decreased because of an improved water source, the most often named diseases were diarrhoea (40%) followed by vomiting, abdominal pain, fever, and fatigue (all about 3% to 8%). Fatigue and fever were excluded given that the former is a bit difficult to measure as a health outcome, and that the latter symptom is also heavily caused by other – non-water related – diseases (e.g. malaria which is wide spread in

[80] Health studies usually use a recall period of between one and four weeks for diarrhoea. An upper-bound recall period of four weeks was chosen here, given the relatively small sample for a health survey, to decrease the stochastic nature of diarrhoeal incidence, which could, however, have lead to higher measurement error.

[81] Measurement error can reduce the statistical significance in any impact evaluation based on econometric techniques.

rural Benin). Figure 13 shows the percentage of households with at least one member (child) suffering from a particular disease within the last four weeks as reported in the dry-season survey of 2010. Diarrhoea is highly prevalent, followed by abdominal pain and vomiting.[82]

Figure 13: *The percentage of households with at least one household member suffering*



Note: Percentages are for the last four weeks.

No 'standalone' health effects of an improved water source were found: not for an improved water source in general, not for first time water access, and not for children, or the population in general. Given the results of Section 3.4, which show no effect of an improved water source on water quality (measured with E. coli) at point of use and only a modest effect on water quantity, it is not surprising that little effect of an improved water source on health are found.

The oral-faecal transmission through water of bacteria such as E. coli is closely related to hygiene behaviour and sanitation. To avoid recontamination of clean drinking water, sufficient quantities of water are a necessary but not sufficient condition. While treatment with an improved water source has clearly had a positive impact on the amount of water

[82] Note that these prevalence rates are by definition much higher than prevalence rates based on individuals.

used this has not yet led to a positive health impact for lack of hygiene practice, safe storage and improved sanitation (see Section 3.6). In addition, households continue using unimproved water sources (see Section 3.3) besides the newly installed water point, and water quantity levels were already quite high before interventions took place (Section 3.4). Last, improved water quantity and quality is only one of the faecal-oral pathways and other contamination – hands and foods – might indeed be equally (or more) important.

However, in a cross-section analysis, the correlation of improved water quality and increased water quantity with diarrhoea are supported. A significant correlation of E. coli prevalence in the household water storage container (point of use) on reported child diarrhoea is found. A household where the water storage container is contaminated with E. coli increases by 25% the likelihood that a household had a child (household member) with diarrhoea.

There is only a significant effect of an improved water source in combination with improved water storage/transport and/or a project[83] starting to work on hygiene and sanitation. Table 25 shows that an improved water source in combination with improved water storage and transport lowers the percentage of households with a child (household member) suffering from vomiting within the last four weeks by 4 (6) percentage points, which is a considerable reduction given that in 2010, 'only' 7% (15)% of households had a child (household member) suffering from vomiting within the last four weeks. A further finding is that even though an improved water source alone does not have an effect on children's health, it becomes effective in combination with a project on sanitation, decreasing the percentage of households with a child (household member) suffering from vomiting by 3 (7) percentage points (or 50%). But note that only 6% of localities reported that a project started to work on issues related to hygiene and/or latrines.

Table 25: Effect of water interventions on diseases

	Water intervention	First-time access	Water intervention + water storage	Water intervention + NGO on hygiene
Child diarrhoea	--	--	--	--
Child vomiting (%)	--	--	-4*	-3**
Child abdominal pain	--	--	--	--
Member diarrhoea	--	--	--	--
Member vomiting (%)	--	--	-6 ‡	-7**
Member abdominal pain	--	--	--	--

*Notes: -- not significant, **significant at 5% level, *significant at 10% level, ‡significant at 15% level*

[83] We did not find any effects of a combination of an improved water source with a community health worker.

The question is why an impact is found for an improved water source in combination with improved water storage and in combination with sanitation projects for vomiting but not for diarrhoea and/or abdominal pain. One explanation is high measurement error for self-reported diarrhoea and abdominal pain: there is not a clear cut definition for diarrhoea (or when somebody starts reporting abdominal pain), whereas vomiting is a dichotomous health variable that is easier to observe by the (adult) family members engaged in the survey. Another problem might be the recall period of four weeks, leading to further measurement errors.

Health costs of water-induced diseases

Evaluation question 20: *What have been the effects on the number of days sick for the population? Has there been a reduction of health costs for the population?*
Given that the analysed water related diseases have not been decreased after the construction of an improved water source, this question cannot be answered sufficiently. As an alternative, the yearly health costs of diarrhoea for an average household in rural Benin are estimated. Households spent on average about FCFA 30,000 for the treatment of diarrhoea per household per year, or 3% of a household's yearly income. An additional 39 working days are lost, leading to an income reduction of about FCFA 39,000.

Given that no effects of an improved water source on water induced diseases were found,[84] changes in number of days sick and/or reductions in health costs could not be assessed. As an alternative, this section analyses the 2010 level of incidence, as well as days and health cost lost because of diarrhoea. Table 26 shows the high burden of diarrhoea in Benin for 2010. It shows that 27% of children under the age of five were suffering from diarrhoea within the last four weeks in the survey. For adults this figure is much lower, but still considerable, with 18% of adults having suffered from diarrhoea within the last four weeks. Figures are similar for the rainy season.[85] On average, people suffer for about four to five days with diarrhoea if it occurs. The costs associated with treating diarrhoea are also considerable: on average around FCFA1,800 is spent on a diarrhoea cases, which is equivalent to about two days of labour income in rural Benin.

[84] Only in combination with improved water storage (which was only the case for 18% of localities) and/or a sanitation project in the village (which was only the case for 6% of localities).

[85] Note that even though measurement error in individual disease incidence influences the significance of results from double difference analysis, making results less significant (see previous paragraph), they do not influence means or levels of estimates, where measurement error is cancelled out between observations.

Table 26: Diarrhoea incidence and costs		
	Children	Adults
Per household	2.9	3.9
Diarrhoea within last four weeks – dry season (%)	27	18
Estimated diarrhoea cases per household per year	9.39	8.42
Costs per diarrhoea case (FCFA)	1,770	1,897
Days sick per diarrhoea case	4.62	4.59
Observations	1,793	7,484

Using the information on the probability to have suffered from diarrhoea within the last four weeks (one month) in combination with the number of children/adults per household one can calculate the diarrhoea cases per year and per household.[86] Multiplying this number with the estimated costs for treatment as well as with the adult-days lost per disease incidence, the income burden of low water quality, quantity and hygiene for an average household in rural Benin can be approximated. To give a value to the number of adult days lost average daily wages in rural Benin (FCFA 1000) are used. It is estimated that households spend on average about FCFA 30,000 per year to treat diarrhoea, which represents about 3% of a household's yearly income. If one includes the number of days during which adults are sick because of diarrhoea and are hence unable to work properly, an additional hypothetical FCFA 39,000 is lost.

3.8 Investment and fee structure

Investments for water and sanitation

Evaluation question 21: *What is the investment structure of water and sanitation service delivery?*
Localities contribute on average about 1% of initial investments for improved water points. The self-reported locality contribution is on average 25% to 40% higher than the foreseen fixed amount by the Direction Générale de l'Eau (DG Eau). The average contribution of individual households varies considerably between EUR 0 and EUR 10; with richer (and larger) localities paying on average less per household, but richer households within localities paying on average more. For sanitation, investment costs for private latrines are in most cases fully borne by the households and are reported to be around EUR 150 per household. The mean willingness to pay for investments in private latrines is estimated at about EUR 50.

[86] The assumption behind this calculation is that the probability to fall sick of diarrhoea is the same for all months during the year and that a disease incidence in one month does not influence the probability of falling sick in the next month.

Table 27 shows the investment structure of improved water points, separately for public standpipes and manual pumps. Row 1 represents the average investment costs as provided from the regional Services d'Eau (S-Eau). Row 2 shows the fixed – independent of actual local investment costs and population sizes – contribution of localities as specified by the DG Eau. As can be seen, this contribution of localities represents a small share of the overall investment costs for public standpipes and/or manual pumps, accounting for not more than 0.8% (standpipe)[87] and 1.1% (manual pumps) of the total investment costs of these water facilities. Investments by localities are, however, not seen as a cost sharing mechanism, but rather as a demonstration of their demand for a new water point as well as their commitment towards proper care and operation and maintenance of the facility.

Table 27: Investment structure

	Public standpipe	Manual pump
Total investment costs[88] (FCFA)	25,000,000[89]	8,961,000
Official locality investment (FCFA)	200,000	100,000
Real locality investment (FCFA)	246,950	141,752
Observations (localities with main water source)	29	93

Interestingly, the self-reported contribution at the locality level for the main water source of the locality is on average about 25% to 40% higher than the officially planned contribution (Row 3). Some localities even report to have spent FCFA 800,000 and FCFA 350,000 for a newly installed public pipe or manual pump, respectively, whereas other reported zero contribution at the locality level. Hence big differences in (reported) investment contributions to water points exist – even though it should be the same across all localities. According to the DG Eau, it is up to the community leader to decide how much the population of a locality contributes and how much is paid from the financial resources of the community (or from external sources). This explains lower than foreseen investments at the locality level, but not higher investment costs. One explanation is that in previous schemes (i.e. before 2008), localities had to contribute somewhat higher investment costs and some water points analysed in this section (that looks at all water points of a locality irrespective of the time of installation) certainly fall under previous contribution schemes. At the household level, only 19.6% of households using a standpipe report having contributed to the construction of it whereas 60.9% of households using a manual pump report having contributed to it. Including the zero-payments of households that contributed nothing to the newly installed water point, the average contribution of

87 This is only for the construction of the surge tank. The total cost of a public standpipe depends on people served and installed pipe metres. The 0.8% hence represents an upper bound of the investment costs covered by localities.

88 Calculation based on budgeting of respective Services d'Eaux. Source: www.igip.com

89 FCFA 25,000,000 is only for the construction of the surge tank. It is estimated that per person served and per metre pipe an additional FCFA 3,000 for each person and FCFA 6,000 for each metre pipe have to be added.

90 Source : Chargé de la Composante Hydraulique rurale, Programme Eau Potable, GTZ Benin.

households to set up a water point is about FCFA 750 (EUR 1.14) for standpipes and FCFA 2,856 (EUR 4.30) for manual pumps, with a considerable share of households contributing about FCFA 6,000 (EUR 10).[91] Standpipes are often built in larger localities, which explains the lower costs per household and the relatively few households contributing in general.

If one correlates households' contribution with the wealth of the households, one observes that whereas the 40% richest households within a locality contribute on average FCFA 1,400 more to a newly installed water point than the poorest 40%, the 40% richest localities pay on average FCFA 3,000 less per household than the 40% poorest localities. Poorer localities have on average smaller populations (i.e. fewer households) which lead to a higher amount per household for a newly installed water point.

Considering the cost structure for improved sanitation in rural Benin, the few households that own a private latrine in our sample (10%) reported that, on average, they spent FCFA 96,393 (EUR 150) to get access to an improved sanitation facility.[92] This seems to be a very high investment cost in comparison to what households usually contribute to gain access to an improved water source (about FCFA 2,856, or EUR 4.30). Households without a latrine overestimate the amount needed to build a latrine by about 50%, and estimate the investment costs of a latrine at FCFA 152,851 (EUR 230).

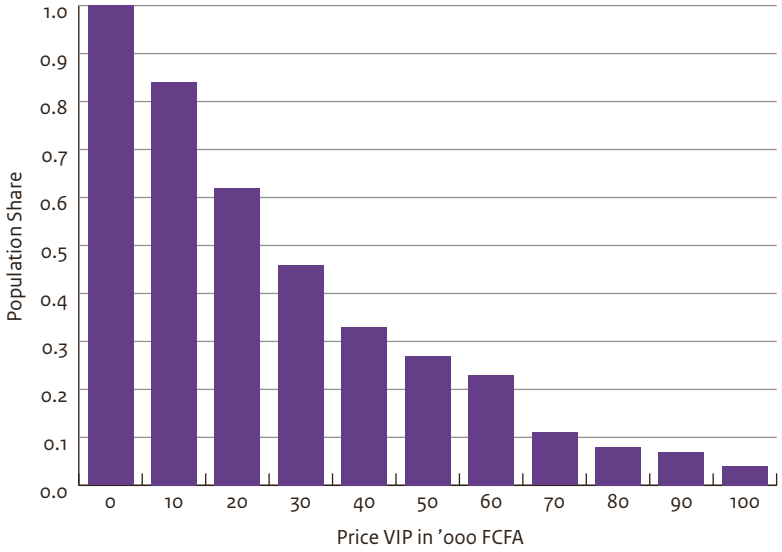
Conducting a simple contingent valuation analysis – asking households for their willingness to pay for an improved latrine – the mean willingness to pay for an improved latrine was estimated at FCFA 33,188 (EUR 50), i.e. a third of the usual costs. The estimated price elasticity of demand for an improved latrine is shown in Figure 14. About 46% of households would be willing to pay FCFA 30,000 for an improved latrine. This means that the costs of a private latrine should drop by two-thirds before at least half of the households would be willing to invest in improved sanitation. Hence, costs are a major obstacle to an increased use of improved sanitation. This is also confirmed by the fact, that whereas 17% of the richest quintile of households in the sample already uses a private latrine, only 2% of the poorest quintile of households has access to a private latrine.

Only, about 8% of households (without a latrine) would be willing to pay the current costs of a latrine of FCFA 90,000. Note that a low percentage is reasonable here, given that households that have a willingness to pay for a latrine that is equal to the actual costs should already have one – assuming that they are well informed about the investment costs of a latrine. This is, however, not always the case as households without a latrine have a tendency to overestimate the costs of a private latrine by about 50%.

[91] This information was collected at the household level, asking households how much money they contributed for the installation of the new water point.

[92] This figure was confirmed by interviews with NGOs working within the sanitation sector in Benin and is at the lower bound of estimated investment costs for simple sanitation in SSA (Hutton and Haller, 2004).

Figure 14: *Price elasticity of sanitation demand*



Fee structure and cost recovery

Evaluation question 22: *What is the fee structure of service delivery and what is its potential for maintenance and/or cost recovery of service delivery?*[93]

Most improved water points collect water fees (about 85% to 95%). Whereas standpipes collect on average 3.2 euro cents for one container of water (25 litres to 40 litres), manual pumps collect only about 1.7 euro cents for the same quantity. About 16% to 34% of improved water sources (that usually collect a water fee) do not collect water fees from every household every time. Comparing reported with calculated revenues from the water points per day, it seems that about 20% to 30% of water containers collected from a water point are not paid for. Per year, water points seem to collect at most EUR 750. Given this payment structure, cost recovery of investments seems to be implausible, whereas maintenance/reparations seem to be guaranteed (at least from a financial point of view).

[93] Paying a fee for the use of a latrine is basically non-existent in rural Benin, so we concentrate on water service delivery. Only 0.35% of households using a private and/or public latrine reported paying fees for its use. Moreover, during focus group discussions the option of paying fees for going to the toilet was considered as 'not acceptable' (the principle is well-established and accepted, though, at markets).

Table 28 shows that 95% of localities with a standpipe reported that in general they collect water fees. In contrast, only 86% of manual pumps collected water fees. Note that this does not necessarily mean that 95% (86%) of standpipes (manual pumps) collect water fees from each household every time. Indeed, it was reported that 16% of public standpipes and even 34% of manual pumps have customers who, from time to time, do not pay for the water they collect. This obviously reduces the exclusion of households from improved water sources (if it is indeed poor household that receive this preferential treatment), but also reduces the sustainability of water points. Unimproved water sources usually do not collect any water fees: only 17% of unimproved water sources collect fees (mostly traditional wells).

Table 28: Fee and revenue structure

	Public piped	Manual pump	Unimproved water source
% of water points that collect fees	94.9	85.7	17.1
Fees per water container (FCFA)	21.6	13.2	11.9
% of water points where households avoid paying[94]	16.2	34.0	19.5
Water containers collected per day	95	121	107
Calculated revenues per day (FCFA)[95]	2,223	1,510	1,434
Reported revenues per day (FCFA)	1,454	1,291	917
Observations (localities)	137	222	269

The average water fee collected at public pipes is about double the amount collected at manual pumps and/or unimproved water sources: FCFA 21 (3.2 euro cents) for a container (25 litres–40 litres) of piped water versus FCFA 13.9/ to FCFA 11.9 (1.7 euro cents) for a container from a pump and/or unimproved water source.[96]

The estimated number of water containers (paid and unpaid) collected per day seems to be slightly higher at manual pumps (121 containers) than at public standpipes (95 containers). Given that in rural Benin traditional water containers for transport contain between 25 litres and 40 litres, we estimate that on average about 2,500 litres to 4,000 litres are collected from a water source per day. Combining the number of containers collected per day from a water point with its respective fee structure, the potential revenues per day (if every single container would have been paid for) can be derived. At a different point in the locality questionnaire information was asked directly about the daily revenues from a water point. The calculated revenues per day from the sale of water are FCFA 2,223 (EUR 3.40) and FCFA 1,510 (about EUR 2.30) for a public standpipe and a manual pump, respectively. The average

94 Of water points that usually collect water.

95 In a first step, the fees per container times the number of containers collected from a water point is calculated for each water point. Thereafter the average revenue across all water points is calculated.

96 Figures reported here correspond to the locality questionnaire. The data was verified by directly asking households in a household questionnaire about whether they have to pay for water, how much and if they try to avoid paying from time to time. On average, the results largely correspond to the figures in Table 24.

reported revenues of the water points are, however, about 20% to 30% lower, indicating that not every water container collected is paid for. Note that this difference could also be caused by measurement error, or the respective responsible person not willing to report the 'true' revenues per day because of some 'alternative' use of the water funds.

Given the estimated daily revenues and the high investment costs of improved water points as well as the rather low upfront locality investments, it does not seem feasible to sustain investments into, or rehabilitation of, water points. Manual pumps collect about 5% of the initial investment costs per year, leading to an amortization time (in the most optimistic case) of 20 years[97] – even if no operational and maintenance costs would occur, and even if households would collect water from this source also during the rainy season, which is not always the case (see Section 3.3). Given the much higher investment costs of public pipes (FCFA 25,000,000 + FCFA 3000 per person + FCFA 6000 per piped metre), the amortization time of a public standpipe seems to be even longer – even if we consider that one facility will in general relate to more than one public standpipe.

With regard to maintenance costs, the fee structure seems, however, to be high enough to pay for any reparations that occur. Water sources that have had some problems in the past were repaired at an average cost of FCFA 74,802 (EUR 114). Given that, on average, an improved water source has an income of about FCFA 1,300 (EUR 2) per day, the costs of repair are equal to about 58 days of water source revenues.

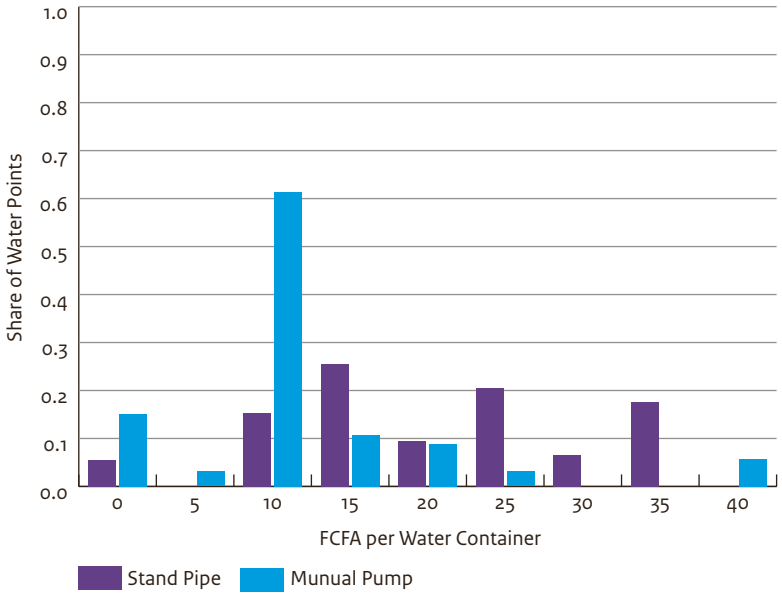
The drivers of water fees

Similar to investments, the fee structure for an improved water point also varies considerably across localities (see Figure 15). Whereas most (about 60%) of manual pumps collect FCFA 10 per water container, about 40% of manual pumps collect less or more (up to FCFA 40) fees. For public standpipes, the variation of water fees is even greater (see Figure 15). The question is hence, what determines the amount that has to be paid to collect water from a specific improved water source. To answer this question a cross-sectional regression analysis is applied to the 2010 data.[98] The results are reported in Table 29 and represent the change in water fees measured in FCFA that is correlated with various locality specific characteristics.

[97] Assuming linear depreciation and zero interest rates.

[98] The determinants at the locality level are unlikely to change over the period of one year (besides water infrastructure). A double difference analysis over time can therefore not be applied as was done for most other estimates of this impact analysis.

Figure 15: *Fee distribution*



The fee charged for water is highly determined by the type of water source. On average, the price for a water container from a manual pump is FCFA 8 higher than from an unimproved source, and the price charged at public standpipes is FCFA 16 higher than the price charged at unimproved water sources. Moreover, poor localities charge lower water fees for a container of water (FCFA 3.63 less).[99] Furthermore, the number of modern water points per 100 households within a locality has a high and statistically significant positive effect on water fees[100]: One water point more per 100 households leads to an increase of FCFA 0.93 per water container collected (the average within the sample is three water points per 100 households).[101] This indicates that at the locality level, higher water supply is not correlated with lower prices, for example as a result of competition between various modern water sources. This result rather suggests that some price coordination takes place between water committees and/or private operators[102], while households seem to be willing to pay a bit more if more water points per households are available, i.e. if water sources are on average closer to the home and queuing times are less and hence service levels are higher.

99 A locality is defined as poor if the mean of the wealth indices of its households is found in the bottom two quintiles of all localities.

100 In this regression 'water points per household' and not 'households per water point' was analysed, which might seem somewhat more intuitive. The reason is that some localities do not have any modern water points. These observations would have to be dropped for the analysis, due to zeros in the denominator. We look at number of water points per 100 households and not per household for easier interpretation.

101 Note that the acceptable standard is about 40 households per water point, or 2.5 water points per 100 households.

102 Where municipalities take over the water points, prices will definitely be the same across water points, as the municipality will set one fee for all water points – at least for AEVs (see Chapter 4).

Table 29: Determinants of water fees		
DEPENDENT	Water fees	
	Coefficient Representing costs in FCFA	p-value
Unimproved water source	ref.	
Manual pumped water	7.72***	<0.01
Public standpipe	16.19***	<0.01
Modern water points per 100 households within locality	0. 93***	0.01
Number of additional localities using water point	0.72***	<0.01
Poverty Indicator	-3.63***	<0.01
Number of households	0.01**	0.04
Collines	-0.93	0.29
Adj. R2	0.47	
Observations	642	

*Notes: ***significant at 1% level, **significant at 5% level*

In contrast, an additional locality collecting water from a certain water point increases water fees by on average FCFA 0.72. Some 60% of water points in the sample studied are used by only one locality, whereas 18% are used by two localities and about 20% are used by three or more localities. This increase in water fees speaks for a shortage of water supply in localities surrounding the specific locality, leading to a higher demand for water from this particular water source, leading on average to higher water fees at this particular water point. This price response to more localities collecting water from a specific point should restrict demand somewhat, and thus prevent excessive waiting times.

The effect of poverty, modern water points per 100 households, and number of additional localities collecting water from a water point on water fees is, however, very small in comparison to the effect of the type of water source.

The consequences of water fees

Evaluation question 23: *What is the impact of a newly installed water point on water fees and are water fees a problem to the budget of the households targeted?*

A newly installed water point increases water fees by, on average, FCFA 2 to FCFA 4 per water container collected by households. Households that switch from a cost-free to a paid-for improved water source experience a cost increase of about FCFA 10 to FCFA 20 per water container collected. If those amounts

are multiplied by the quantity of water collected per household per year, it is estimated that on average households have to spend 1% to 4% of their annual income for water consumption if they collect all their water consumed from a manual pump/public standpipe. For the poorest 40% of households, collecting all water from an improved and paid-for water source means spending about 3% to 7% of their income on water fees.

Table 30 reports double difference estimates for the impact of an improved water source built in the locality on the fees paid per water container by the households in a locality. For households, a newly built improved water source increases the average price paid for drinking water by FCFA 2 per water container (about 25 litres to 40 litres) in general, and by about FCFA 4.5 per water container if no other improved water source existed before (first-time access). The positive price effect for first-time access reflects the fact that households switch from a usually unpaid traditional source to a paid modern source. For other modern source additions (second, third, etc.) the effect is smaller and only marginally significant. Moreover, the rather small changes in prices (both for general treatment and first-time access) are caused by the fact that a) not all households start collecting water from a newly improved water source if installed (see Section 3.3), b) some households avoid paying from time to time, and c) some unimproved water sources also ask for a water fee.

Table 30: Effect of water intervention on water fees

	Outcome: Fees paid per container					
	All interventions			First-time access		
	2009	2010	Difference	2009	2010	Difference
Control (FCFA)	8.56	9.58	1.02	8.56	9.58	1.02
Treatment (FCFA)	7.44	10.24	2.80	3.58	9.13	5.55
Double difference (FCFA)			**1.78**			**4.53**
P-value (regression)			0.11			0.08
Observations			3,908			3,908

What impact do these increased water fees have on households' total expenditure? On average, households collect about 4.4 water containers per day from their main water source, or 1,500 water containers per year. In Section 3.4, it was shown that the quantity collected from the main drinking water source does not change much with an improved water source. (It is now clear that this small quantity effect is the sum of a positive effect (through better access) and a negative effect through higher water fees.) The total annual fee increase for households in a locality with a new water point is hence about FCFA 3,000 to FCFA 6,750 (about EUR 5 to EUR 10) for households on average (including households that decide not to use the new water points and non-payers). If one only takes into account households that actually switch from a cost free unimproved water source to a public standpipe or a manual pump, the increase in annual water fees is about FCFA 15,000 (EUR 23) to FCFA 30,000 (EUR 45). These amounts represent on average 1% to 4% of a household's yearly income, which was estimated to be FCFA 1,109,672 (EUR 1,600) for Collines and FCFA 886,630 (EUR 1,300) for Mono-Couffo (EMICoV Household Survey, 2007). For the poorest 40% households in these

regions with a yearly income of FCFA 583,570 (Collines) and FCFA 457,893 (Mono-Couffo), those water fees would constitute about 3% to 7% of their yearly income.

Of the households that use a water point where fees are collected, 20% reported that they were sometimes unable to pay the water fees within the previous four weeks. However, in general, water fees are not considered high by most households that use a water point where one has to pay fees, and 50% of households even reported that water fees are a negligible amount of their households' income. It is, however, also interesting to look at the percentage of households that do not use an improved water point that collects water fees, even if accessible. Of the households living in localities that had received a new improved water point within the previous year, about 30% of households reported not using this water source. Of these, 14% reported not using it because they considered water fees too high. Hence, 4% of households do not use a newly installed improved water point because of water fees.

3.9 Summary and conclusion

Water and sanitation interventions and access

This quantitative impact assessment is based on 200 localities in Mono-Couffo and Collines, of which 40% (78 localities) received a new water point during the study. The *département* of Borgou – initially included in the study – was dropped from the survey because of negligible water point realisation in 2009. For Mono-Couffo and Collines, the rate of water point realisation within the year planned seems to be modest: Of the 2008 water supply planning only 10% were realised in 2008 and a further 52% in 2009. Of the 2009 planning 49% of the planned water points were installed in 2009.

Of the 78 localities that received a water intervention in 2009, 40% had no improved water point and 22% had only one improved source and a very low service quality (i.e. high number of households per improved water source). However, the remaining 38% of localities were relatively well served already before 2009 and nevertheless received a third or fourth water point in 2009.

Prior to 2010, the water allocation process was largely 'demand-driven'. This has contributed to the observed pattern of repeated allocations to the same localities, even if service levels in terms of households per water point were already adequate (according to the set standard by the DG Eau). There is already a policy intention in Benin for more centralized 'database planning' with higher priority given to localities with large populations relative to the existing infrastructure. More generally, moves towards an equitable distribution of water services would require a solid and regularly updated locality level database of existing water points to be used for future planning and implementation.

Given that 62% of localities received a second, third or fourth water point, the expected and observed changes in outcomes (such as quantity and quality of water) are smaller than would have been the case if only localities with no prior improved water source had been targeted. In 2009, poorer or smaller localities were neither more nor less likely to receive another improved water point, whereas the probability of having at least one improved water point at the beginning of 2009 was clearly greater for wealthier and more populous localities. Under the past 'demand-driven' allocation regime a locality needed a certain minimum purchasing power to make the initial investment of about EUR 200. The combined locality purchasing power is determined by the number of households contributing and their mean wealth. However, larger localities did not always have more improved water points per capita.

In comparison to water access and use, sanitation coverage and use is very low in rural Benin especially among the households on the water planning lists for Mono-Couffo and Collines. Before the analysed interventions took place, only 10% of localities had access to a public latrine and in total only 10% of the population were using a private and/or public latrine. Even though there seems to be a consensus among policy makers and authorities that water supply interventions should be followed by hygiene education and latrine promotion, during 2009 only 10% of the localities that received a new water source within the last year reported that a project started to work on sanitation and hygiene related issues, and only 35% reported that a health community worker started to educate the population on hygiene-related issues.

Effects of water and sanitation programmes

Before programme implementation in 2009, 52% of households in the intervention localities were already using an improved water source. After the improved water points were installed, the proportion of the locality population using an improved source as a main source for drinking water increased by about 30 percentage points to 82%, or on average by 25 households (with an average locality size of 81 households). This does not include other localities that have also started to use this improved water point. Only 60% of the water points studied are used by just one locality. For localities where the installations were the first improved water sources, the effects are considerably greater. An increase in the use of an improved water source from 0% of households to 74% of households (or 62 households in total) could be observed within one year.

In many cases, households continue to use an alternative unimproved water source. Hence, the increase of households using an improved water source exclusively due to the installation of a new water point was only 16% for all interventions and 46% for first-time access to an improved water source. Mixing of water from different improved and unimproved sources decreases the potential health effect of an improved water source. During the rainy season, many households use rainwater – which is of relatively good quality – for drinking, so the impact of an improved water source on usage rates is somewhat smaller.

A newly installed improved water point for the locality also leads to an increase of 7 litres collected per person per day, or an increase of about 25%, given that households consumed about 30 litres per person per day before the intervention. (In cases where the improved water point is the first ever installed in the locality, the increase is 13 litres or about 40%). However, half of this increase is coming from an alternative – and often unimproved – source. The previous unimproved main source is – after the intervention – often used as a secondary source. Again, this effect reduces the impact of a new water point on water quality and health. A new water point does not increase the water quantity consumed during the rainy season. Although poorer and larger households consume on average 4 litres per capita per day less than wealthier and smaller households, there is no evidence that the analysed water interventions change the quantity consumed by the poorer or larger households differently.

Water coming from a public standpipe or pump is much less contaminated with E. coli (10% of such water points are contaminated) than water coming from an unimproved well (60% of water points) or surface water (80% of water points). However, these differences become practically invisible once water is stored and consumed at the household level: here water has E. coli contamination levels which differ very little according to source. Independent of the main water source used by a household, in about 40% of households, water is contaminated with E. coli. Also, when estimating the impact of an improved water source on E. coli contamination at the household level no effect was found.

However, there is strong evidence that the distribution of new and improved water storage and transport containers reduced household level E. coli contamination by more than 50%. There is no evidence of complementarities between water supply and hygiene education with respect to water quality. In other words, from the point of view of household water quality, offering a combined locality treatment consisting of both an improved water point and hygiene promotion is not more effective than offering either of these separately. It is, however, unclear if there were complementarities if hygiene promotion would be delivered in a more effective way.

When a new water point is installed, households save on average 15 minutes – or about 30% of the time – to collect one container of water (about 40 litres). In the case where the first water source is built within the locality the average time for a round trip to collect water is reduced by 20 minutes or about 40%. No time savings are found for the rainy season. Furthermore, queuing is an important factor when considering water collection, taking up about 50% of the total process, and is obviously dependent on the number of households per improved water source. It is therefore not surprising that relatively modest reductions in distance – from the household to the water source – are found when an improved water source is built (about 100 to 250 metres) whereas time savings appear large. Another consequence of this result is that the time savings achieved are much larger for smaller (and hence often poorer) than for larger localities.

Some 80% of individuals engaged in water fetching are women. Every third (fifth) household sends a girl (boy) below the age of 16 to collect water. It is therefore mostly women and girls

who benefit from time savings. In Mono, the number of enrolled girls increased by about 39 girls (or 20%) as a result of the installation of a new water source. This effect was not found in Collines. No such effect is found for children in general. Only 35% of women report that they use the time gained from water collection for economic activities. Others report increased free time or higher involvement in housekeeping activities. Given that result, we estimate that an average households' income in the studied localities increased by about 1% as a result of the time savings achieved and used for productive activities.

During 2009, both access to as well as use of sanitation facilities increased modestly, but much less than the access to and use of improved water sources. The percentage of households that reported using improved sanitation (private and/or public latrines) rose from about 8% to 10%. Whereas often it seems (and also in this study) that in the long-run public toilet construction has little impact on toilet use, in the short-term a new public toilet almost doubles households' toilet use. This finding, in combination with qualitative responses from households, indicates that it is not that people do not want to use public latrines in general, but that problems of cleaning, maintenance and emptying lead to a deterioration of public sanitation facilities in the long-run, making them unusable. Moreover, it seems that for private latrines, households miss the appropriate funding. Households currently have to spend about EUR 150 or 10% of average yearly income to obtain a private latrine. In contrast, the contribution of a household for an improved water source is only between EUR 0 and EUR 10. The mean willingness to pay for private latrines was estimated at around EUR 50. Subsidizing the difference between costs of installation and measured households' willingness to pay for private latrines, where maintenance and cleaning is less of a problem should be a good policy option.

Hygiene practices with regard to waste treatment and water handling are not widespread in rural Benin. This is certainly one reason why initially clean water at source is contaminated when used at the household. Overall, there was little change in hygiene practice during the study period but community workers seem to have had some positive effects on safe waste treatment, but not on water handling. Given that hygiene practices are not widespread in Benin and that no effect of an improved water source on water quality could be found, it is not surprising that no impact of an improved water point on (self-reported) diarrhoea, vomiting or abdominal pain could be found – even though all of these diseases are highly prevalent in rural Benin, both among children and adults. For example, 40% of households reported having at least one member suffering from diarrhoea within the previous four weeks (20% of households reported a child with diarrhoea). Hence the water-related disease burden remains high. Results indicate that households spend, on average, about FCFA 30,000 for the treatment of diarrhoea per year, or 5% of yearly income. An additional 39 adult working days are lost, leading to an additional income loss of about FCFA 39,000. The results of this study also show that both a reduction of E. coli contamination at the household source as well as an increase in water quantity consumed (per capita per day) is significantly correlated with a reduction of water-related diseases. Hence, also in rural Benin, water quality and quantity are relevant for a reduction in the disease burden, but an improved water source alone at least in the past often had no effect on water quality.

Investments, fees and economic viability

Localities contribute, on average, only about 1% of the initial investment costs for an improved water point (about EUR 150 to EUR 400 of about EUR 13,000 to EUR 40,000). The average contribution of individual households varies considerably with richer (and larger) localities paying on average less per household, but richer households within localities paying on average more. Whereas standpipes collect on average 3.2 euro cents for one container of water (25 litres to 40 litres), pumps collect only about 1.7 euro cents for the same quantity. Comparing reported (on average about EUR 2.60 to EUR 3.20) with calculated revenues from the water points per day, it seems that about 20% to 30% of water containers collected from a water point are not paid for, which has obviously negative consequences for the sustainability of water points. Per year, water points seem to collect at the most EUR 750. Given this payment structure, cost recovery of investments seems to be unlikely, whereas maintenance and reparation seem to be guaranteed (at least from a financial point of view).

Given that most improved water points (about 85%) collect water fees, whereas most unimproved water sources do not, a newly installed water point on average increases the water fees paid by a household by FCFA 2 to FCFA 4 per water container collected. If one looks only at households that switch from a cost-free to a paid improved water source, the cost increase is about FCFA 10 to FCFA 20 per water container. If water fees of improved water sources are multiplied by the quantity of water collected per household per year, it is estimated that an average (poor) household has to spend 1% to 4% (3% to 7%) of its annual income on water consumption if all water consumed is collected from an improved source and paid for.

4

Sustainability assessment

4.1 Introduction

As stipulated in Chapter 1, questions in the original terms of reference on institutional analysis have been focused on factors that affect sustainability of interventions and beneficial impact. Sustainability is defined as the (probability of) continuation of benefits after major development assistance has been completed.[103] In addition to institutional factors, linked as they are to society's governance and politics, the assessment addresses relevant economic and environmental determinants of sustainability.

Sustainability of beneficial impact was assessed against the background of the recent change in the rural water supply and sanitation strategy and the ongoing shift from community-based management of rural water supplies to municipalities taking charge and contracting out management services to private companies. For the current strategy, assessment of sustainability may seem premature. Definite conclusions on sustainability of the new 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. These include technical factors (such as the durability of infrastructure, operation and maintenance), economic factors (such as willingness and capability to invest and pay for services), and environmental factors (such as groundwater availability). Linked to these sets of factors, the structure, capacities and performance of institutions are major determinants of sustainability of rural water supply and sanitation interventions. These institutional factors, linked to society's governance and politics, are often most influential. This chapter offers findings indicating trends towards sustainability with particular reference to questions 24-28, listed below.

Sustainability assessment

24. Are existing hand and foot (manual) pumps and small piped systems functioning and for how long?
25. Are the rural water supply and sanitation strategy, institutional structures and roles clear, applied and accepted?
26. Do the relevant institutions have the capacity for sustaining water supply infrastructure and services for water supply and hygiene and sanitation promotion in the long term?
27. Are costs recovered and are adequate financial arrangements for sustaining interventions made?
28. Are there other factors that affect sustainability not captured under question 24 to 27?

[103] This definition of sustainability is derived from the OECD–DAC Glossary of Key Terms in Evaluation and Results-based Management.

Question 24 refers to rural water supply infrastructure which has been created mostly as a result of the previous rural water supply strategy. The findings regarding questions 25 to 28 concern the current strategy.

Question 26 refers to a range of key institutional actors, notably municipalities (supervision, contracting out services, funding major repairs and replacements, monitoring, accountability), private sector companies (installation, maintenance, management), water user organizations (management, user/consumer interests), social intermediation (ImS) NGOs (facilitation of strategy implementation), the water departments and the directorate of the water authority (technical assistance, policy, regulation, monitoring), the Ministry of Health (water quality, hygiene and sanitation policy, interventions), the Ministry of Finance (funding of policy implementation) and donors. The focus of the study has been on actors at municipality and community level, being most crucial for sustaining interventions.

Question 27 addresses the policy principle of cost recovery and the financial arrangements made for major repairs and replacement of water supply infrastructure. Question 28 addresses other factors that may affect sustainability, notably environmental factors such as groundwater availability, and factors of governance and politics, in particular women's participation; compliance with rules and regulations; coordination between relevant actors and accountability; monitoring of local processes and bottlenecks that undermine sustainability and follow-up.

The chapter is structured as follows. Section 4.2 addresses the functioning of existing hand pumps and foot pumps and AEV's. Section 4.3 presents findings on clarity, application and acceptance of the new and evolving rural water supply strategy. The following Section 4.4 presents findings on the capacity of relevant institutions for sustaining infrastructure and services in the long term. Section 4.5 addresses cost recovery and financial arrangements and Section 4.6 continues with environmental factors and factors of governance and politics. Each section starts with the evaluation question and summary answer followed by an account of findings. The chapter ends with a brief summary and conclusion.

4.2 Functioning of manual pumps and AEVs

Evaluation question 24: *Are existing hand and foot (manual) pumps and small piped systems functioning and for how long?*

The majority of the used rural water points in the sample locations were functioning at the time of the survey. However, many water points have had interruptions and repairs on average take a long time. A substantial part of the water points built within the last three to five years have been abandoned. Reported factors that explain discontinuity are: difficulty to get in contact with technicians resulting in delay in repairs, insufficient funds for (major) repairs, lack of spare parts, lack of preventive maintenance, conflict between different user groups causing discontinuity after a break down and lack of transparency of financial management of water facilities. Other factors may be weaknesses in planning, design and installation of facilities. A substantial part of abandoned water points has been rehabilitated by the government supported by donors.

Exploitant small piped water supply system

In 2010, respondents of localities in the sample were asked to report all used and not used (abandoned) improved water sources that are situated within the boundaries of the locality. Some 16 % of localities reported that they still had no improved water source, 33% reported having one improved water source, 23% reported having two improved water sources and 28% reported having three or more improved water sources. In total and for the 200 localities, 483 improved water points were counted.

A substantial part of the improved water points is abandoned over time. Of the water points built within the previous year, 1.2% had been abandoned at the point of interview. Of the water points built two years previously, 3.6% were no longer in use. The data analysis further shows that of the improved water points built in the three to five years prior to the interview, 20 % were not in use anymore at the point of the interview. This high percentage is remarkable and may indicate weaknesses in the planning, design and installation phase. The DG Eau has provided information on the number of rehabilitated water points, being 1651 in 2009, which is 10.4% of all functional water points (DG Eau, 2009).

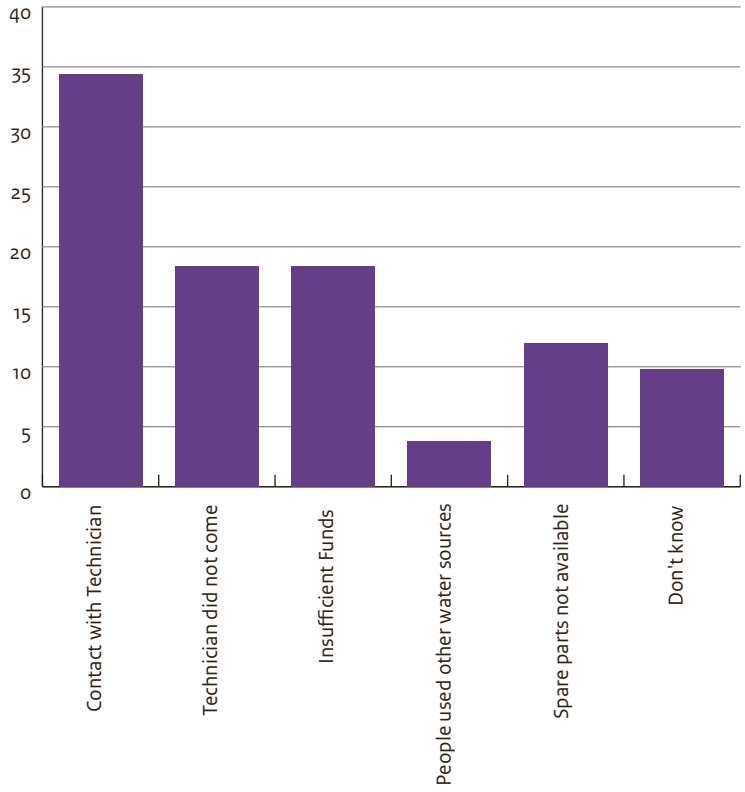
Of households that report using an improved water source as their main drinking water source, 43% (41%)[104] report that the water point was never interrupted since installation. The 57% (59%) of water sources that have had some problems in the past were on average repaired within 38 days at an average cost of FCFA 74,802 (equal to EUR 114). The reasons given for the delay in reparation are given in Figure 16. Most often it was problematic to get

[104] Numbers in brackets refer to figures as measured at the household level.

in contact with the technician (35%) or the technician did not come (18%) even after being contacted. Another factor that was mentioned (19%) was insufficient funds for major repairs and replacements. Findings from the survey indicate that, on average, water points have an income of about FCFA 1,500 (EUR 2.30) per day. The repair costs are hence, on average, equal to 58 days of water source revenues.

Focus group discussions confirm these factors that explain discontinuity, in addition to the normal wear and tear, and added a lack of preventive maintenance and the unavailability of spare parts, and lack of funds. The latter is reported to particularly be a problem for AEVs, because of relatively high costs of repairs and replacement of pumps and generators. Conflicts between different user groups causing discontinuity of water supply following a breakdown were also reported.

Figure 16: *Reasons for delays in reparation*



Collines, broken small piped water supply system

Interviewed technical staff responsible for supervising water points pointed to lack of transparency of financial management of most water facilities as a major factor that may undermine sustainability. The quality of financial management was regarded as poor, undermining continuity of service delivery as major repairs and replacement could not be paid for. Particularly AEVs were considered to be at risk, as management of the installation is more complex and the amount of water sold per AEV is considerably larger than for FPMHs.[105] A study undertaken in the Atlantique in 2005, found that for 52% of the pumps, the committees were functional but that for 35% of the FPMHs, a committee no longer existed (Zohou 2006).

This view of technical staff was however not fully shared by the households interviewed during the survey with over 80% of the respondents in general being satisfied with general and financial management. In 56% of the cases, management was reported to inform the community on the use of funds. With respect to awareness of financial management, 57% indicate that a fund for repair works exists, but 29% did not know about it. Focus groups discussions, which were held in communities having problems with water supply, pointed out in 27 out of 30 groups that management committees of water facilities did not account for the revenues from the sale of water and that there was limited control of finances, either by the community or by any external agent. Some community members explained that they did not dare to ask for more transparency because of societal hierarchical relations (seniority, gender, status) (Nouatin and Moumouni, 2009).

[105] Drilled boreholes equipped with manual pumps.

4.3 Clarity, application and acceptance of the rural drinking water strategy

Evaluation question 25: *Are the rural water supply and sanitation strategy, institutional structures and roles clear, applied and accepted?*

The strategy, structures and roles appear to be sufficiently clear to most stakeholders, including the staff of the water directorate and municipalities, but there appears to be a lack of information among the water user committees and consumers. Application and implementation of the new setup is still ongoing and marked by the frictions that go along with shifting responsibility from one set of actors to another. Acceptance of this strategy is high among government, but significantly less so among local stakeholders. Members of the formerly responsible communities express their frustration with having been sidelined; in particular the transfer of financial reserves for repairs to municipalities and the handing over of partly communally paid-for infrastructure to private companies has been a bone of contention.

Clarity

As discussed in Chapter 2, the most important policy change relevant for this evaluation is, arguably, the revision of the national rural drinking water strategy in order to implement the new municipal responsibilities of the devolution strategy. Major changes brought about by the revised strategy were the shift of management responsibilities and ownership for local water points from local water user associations to municipalities as well as a delegation of formerly central governments' responsibilities to the municipality level. The strategic change from shifting management responsibility from communities to municipalities is followed by contracting out AEV management to private companies.

Findings based on interviews indicate that the current official strategy for rural water supply is clear to most of the stakeholders. The strategy is clear to staff from the water directorate (both central and *départemental* level), staff from ImS NGOs and the technical services staff from municipalities. Information is passed on by the water directorate during regular training sessions held with staff from municipalities and NGOs contracted for social intermediation (ImS). These training sessions are organized by the DG Eau, partly with donor partner assistance, such as from GIZ–DED or international NGOs (for example Protos and SNV).

The revised strategy of 2005 is explained also in manuals[106], which clarify responsibilities of the key actors. Capacity building at the *départemental* and municipality level around these manuals takes place regularly. A reported participatory consultative process has led to agreed cahiers de charges (contract conditions and specifications) for local government, the Ministry of Water, the DG Eau and the S-Eau in 2009.

[106] See, for example, DG Eau publications, such as Intermédiation sociale pour les ouvrages simples, guide à l'usage des commune (2008). Intermédiation sociale spécifique aux adductions d'eau villageoises – le processus de mise en œuvre (2007).

Water user committees and consumers were, at the time of the study, less well informed. Since the 'professionalization strategy for managing water points' took off in 2007, information sharing with and training of water user associations and organizations by the DG Eau was increasingly abandoned, as was reported in Collines. In addition, findings based on interviews held indicate that municipal staff and end users/consumers lack access to reliable sources of information and advice, such as with respect to contracts, price setting, performance of contractors, service agreements and monitoring of water quality.

Application

Application of the new strategy, as may be expected, is still far from complete. Progressively municipalities assume their mandate around planning of new infrastructure and managing of rural drinking water service delivery.

The implementation of the new strategy is marked by a reported growing disregard by DG Eau, municipalities and ImS NGOs for the role that water user committees and communities played in contributing to the sustainability of service provision. Water users are increasingly approached as clients buying water and having to organize themselves (as consumer associations) to defend their interests as users.

Acceptance

The new strategy is generally accepted by governmental actors, Ims NGOs and municipalities, but less by stakeholders with local responsibilities and interests. Municipalities interviewed in Mono and Couffo reported that they no longer asked for a financial contribution from communities for new water points in order to acquire a more 'legitimate' right to decide on management and claim water fees. Interviews in other municipalities indicated that users were still being asked to contribute to the investment costs of the amenity in the other regions. Councillors and staff welcome the additional revenues in the form of water levies. Concerns regarding the speed of implementation and limited flexibility in approach were expressed, however, by municipalities that were visited in Mono and Couffo.

All interviewed councillors with more local responsibilities (chefs d'arrondissements) articulated worries about the sustainability of service delivery. They questioned whether companies would respond on time to interruptions in water supply and take proper care of the equipment. In two municipalities visited, they were also instrumental in organizing complaints concerning the performance of companies. Users interviewed, as far as they were aware of the changes, expressed fear that prices would go up and that they would have even less control than before over the correct management of the water points and timely repair to ensure constant water provision.

All interviewed members of still existing water management committees, of which the facility was to be taken over by a company, expressed strong opposition. Members voiced concern that communities are losing control over water engineering works to

which they had contributed financially. These local committees have opposed municipal initiatives to introduce private sector operators for existing AEVs. Respondents from municipalities mentioned 'resistance' from localities and expressed that they were seeking ways to accommodate some of the frustrations (see also Kpatchavi, 2009). A study on the professionalization of AEVs also recorded conflict and opposition from communities (Ambs, 2010). The DG Eau and municipality staff reported that they perceived this opposition as being organized by committee members who feared the loss of control, income and other benefits from managing water points (see also Belbéoc'h *et al.*, 2008).

4.4 Institutional capacity

Evaluation question 26: *Do the relevant institutions have the capacity for sustaining water supply infrastructure and services for water supply and hygiene and sanitation promotion in the long term?*
Currently, and for the medium term, there are various capacity constraints at the level of municipalities, companies and the water authority which put sustainability at risk. Technical and financial capacity of municipalities to take up a considerable expansion of responsibilities and tasks is still limited. Technical quality of water supply infrastructure is not ensured and technical services for repairs are still underdeveloped. Limited profitability of water facilities in more remote areas that are managed by private companies is reported to be a major issue, which might cause them to withdraw. Like other key institutions in rural water supply, municipalities are hardly investing in hygiene and sanitation promotion, nor in social, economic and environmental aspects of drinking water supply. Municipalities have relied heavily on ImS NGOs for part of these components, but funding is changing and it is not clear whether these NGO services will be continued after donor funding stops. The role of water user committees and associations in sustaining facilities is changing too. Government funding of water supply infrastructure, including rehabilitation has been constrained by delays at various levels, resulting in under-spending. Donor technical assistance provided to build capacity and help the water authority and Ministry of Finance to ensure compliance with rules and regulations is being cut back. The water authority is now responsible for ensuring that the necessary capacities are in place at all levels.

Municipalities

Water supply
Progressively, municipalities assume their mandate around planning and implementation of rural drinking water service delivery, following their establishment in 2003. They are taking up their responsibility for managing water supply facilities and have informed communities and water committees that these infrastructures are publicly owned and are now the property of municipalities.

Municipalities are increasingly responsible for expanding and sustaining rural water supply infrastructure. Some transfer of financial resources has accompanied this transfer of responsibilities. Municipalities have become eligible for such transfers for specific activities and are starting to receive resources through the fund to support municipal development (FADeC).

As heavy drilling equipment and specialist expertise are required for making boreholes, contracts need to have a certain volume before experienced companies are willing to bid for them. Municipalities will have to pool their demands and tenders to achieve economies of scale. Several donor agencies were assisting municipalities and the DG Eau in building *départemental* and regional platforms and structures which is expected to make such collaboration easier (for example AFD, CIRD, GIZ and PPEA).

With respect to procurement, in 2009, a number of municipalities were only responsible for tendering ImS services and public toilets for the PPEA. The procurement role of municipality is expected to expand in the coming years, as more funds for investment will pass directly to municipalities. The PPEA, for example, will channel 20% of the investment funds via FADeC from 2010 onwards. Staff from the water department reported that, currently, tender regulations are not always adhered to at municipality level. Such cases were not corrected by the prefecture, which is responsible for supervising the legality of procedures. Another reported issue is that when commissioning works or equipment, municipalities are not sufficiently aware of safeguards against poor quality of work. For example, they may not make timely use of the period of guarantee to ensure that the water supply facility works properly.

Overall, municipalities have managed to increase the quality and number of staff, mostly using their own resources, but the availability of resources for recruitment differed from one municipality to another. In 2003, 4000 staff members were made available to all municipalities. Most of them used to work for the now dismantled sous-prefecture and belonged to the lower cadres (96%). Up to 2008, the 77 municipalities recruited 400 extra staff with higher levels of education. Some ministries have seconded staff to municipalities. Most municipalities have only one head of technical services (chef service technique), who is generally a civil engineer by training. This person is responsible for all public works in the municipality, including water- and sanitation-related investments and the related management contracts. Technical assistance has been provided for strengthening the technical capacity of municipalities in Mono and Couffo and in some cases also to cover costs of salaries and operational costs (Collines). The municipalities taking over responsibility for the salaries of trained and specialist staff currently paid by donors, was however reported to be a point of concern.[107]

Overall, staff numbers remain too limited for the responsibilities transferred to municipalities (HAADI, 2008). FADeC funds can be used to increase staff numbers . With respect to specialist staff, it may not be feasible for each municipality to recruit the required staff. The sharing of key human resources between several municipalities (mutualization) is being proposed (CPLB–Benin, 2009; Hadonou and Lambrecht, 2009). Various initiatives are in place to develop pre-service training for future professionals with qualifications in (decentralized) service delivery in the water sector. Examples are the Centre d'encadrement des petits et moyens enterprises (CEPEP) – supported by Danida and taken over by PPEA,

[107] Local government informants indicated a lack of ability or willingness to take over responsibility for paying the salaries of staff that have been initially paid for and trained by external donors.

and the Centre de Formation aux Metiers de l'Eau, which was set up by SONEB with German financial support.

The university is now offering an MSc. course on local development. In addition, (short-term) training is available on a range of issues to staff in the water authority, for municipalities and ImS NGOs. Training is offered also to the private sector, such as on feasibility studies, installation, quality control, social intermediation, maintenance, and management. Despite these efforts, there is still a lack of trained engineers. Interviewees also observed insufficient coordination between the various structures and donor agencies offering or organizing short-term training. Concerns were expressed that staff from municipalities in particular may spend more time in training sessions than actually doing their work.

Hygiene and sanitation promotion

Municipalities are also increasingly responsible for hygiene and sanitation promotion. An effective integrated water supply, sanitation and hygiene promotion strategy engaging the community and municipality is still absent. The impact analysis presented in Chapter 3 confirms that access to, and more so the use of, latrines is still very low and that hygienic behaviour related to water, sanitation, and waste is not widespread in rural Benin. No evidence of a positive effect on water hygiene behaviour was found whereas the analysis points to a negative effect of an improved water source on water treatment at point of use. Likewise, reported participation in training for application of hygiene practices related to water treatment, transport and storage of water was low. Moreover, water quality is also not guaranteed. Treatment of water, such as chlorination of water sources, is not systematically promoted. The recent study on AEVs (Ambs, 2010) found that only 25% of the people running the water points were correctly maintaining the water producing unit. There is no system in place that ensures a regular check of drinking water quality produced by AEVs. Many households in the survey sample indicate the apparent high costs of constructing a latrine to be a major obstacle. At the same time, there is divergence on the ground between actors with respect to the promoted technical options and availability of subsidies (reference Chapter 2).

Limited hygiene and sanitation promotion interventions are partly explained by institutional factors. Despite the intended systematic inclusion of sanitation and hygiene in the rural drinking water strategy since 1992, this component continues to receive low priority during resource allocation and implementation. The municipalities and other key institutions with responsibility for water supply and sanitation are overall less attuned to hygiene and sanitation interventions than they are to investing in water supply. Hygiene and sanitation are not priorities in the Ministry of Health.
Hygiene and sanitation are also not part of the evaluation criteria for medical doctors recruited for public health tasks.

Hygiene promotion is taken on by community-based activists, hygiene assistants and technicians at the time that new water facilities are created, facilitated by the Ims NGO, but there is no systematic follow up of actions taken, partly for lack of funds for operational

costs. The contracting out of management of water facilities to companies may make the current community approach to promote improved hygiene practices as part of drinking water development even less effective. Companies are reported to be mainly interested in information and training activities that increase water use, and thus sales, such as the use of safe drinking water and hand-washing campaigns.

Some municipalities have started to address hygiene and sanitation issues in the context of pilot support programmes, developed with assistance of donors (such as Danida and GIZ). However, the study could not prove any significant effects of these activities so far. Moreover, the transfer of hygiene assistants to the town hall, or mairie, is expected to enhance the engagement of municipalities in hygiene. However various informants expressed the view that when setting priorities for allocating scarce resources, these are more likely to go to programming of new water installations followed by contracting out in order to widen the tax base. Municipalities are less likely to invest in an integrated water, hygiene and sanitation approach.

Private sector

Construction

Contracting out the construction of infrastructure to the private sector has been promoted since the first national strategy of 1992. As a result, the national private sector is now playing an important role in providing the goods and services needed to establish and rehabilitate the rural water supply infrastructure. Initially, this concerned activities in relation to designing, tendering, drilling, equipping, and installing physical infrastructure. Consultancy firms specialize in technical and socio-economic feasibility studies, and are contracted to help prepare tender documents (DAOs), monitor the procurement process and check whether the work done is in accordance with technical specifications set out in the terms and conditions of the contract. The sector also includes various pump and spare parts suppliers and construction companies (World Bank, 2004). The technical quality of the water supply facilities is one of the factors determining the sustainability of the infrastructure and thus service delivery. This depends on whether the design and construction of the amenity conforms to norms, regulations and technical specifications.

Currently, technical quality of investment in physical infrastructure for rural drinking water provision is not fully ensured. The relatively large percentage of water points that are abandoned within five years is another concern. Weak links between actors and between levels, limited technical competences of contracted firms, and at times a collusion of interests between contracted firms and inspectors were reported. Moreover, tender procedures are not always applied correctly.

Management of water points

The sustainability of rural water supply infrastructure depends to a great extent on the availability of funding for operation and maintenance, repairs and replacement of infrastructure after major donor funding has ended. This has been one of the reasons for pursuing professionalization of AEV and possibly also manual pumps. As described in

Water tower small piped water supply system

Chapter 2, the second national rural drinking water strategy of 2005 emphasized a need for more professional management of rural water supply facilities and introduced the possibility for municipalities to contract private companies to produce and sell water.

With respect to the professionalization of management, municipalities can choose from four options: delegate management to the reorganized community management committee (AUE), contract management out to a private sector operator with or without the AUE participating in management, or the municipality can take on responsibility for management themselves. Existing AUEs could thus reorganize and adopt a legal status which would allow them to bid for a management contract or collaborate with a private sector operator. For 157 delegated AEVs, data are available on the management option that was chosen. The data indicate that municipalities prefer either a direct contract with a private company (45%) or a tripartite contract which also involves the AUE, but only the private company is again responsible for the management and sale of drinking water (38%). In 14% of the cases, the municipality and the AUE are together managing the AEV and in only 3% is the water produced by a company and sold by the AUE. The last option was reported to be difficult in practice as responsibilities, such as for water loss in the system, are difficult to establish (Ambs, 2010).

All the municipalities interviewed had decided to contract private companies and not to involve the water user committees in the management of the amenities. They give preference to bipartite contracts. Moreover, only one management option tends to be chosen for the entire municipality area, instead of deciding on the best management option on a case-by-case basis (‘tailor made’).

Initially, the 'professionalization' of management was not intended to include FPMH, except for those in the vicinity of an AEV to reduce competition. The discussion on 'professionalizing management' has deepened and the DG Eau now proposes that municipalities also assume active responsibility for FPMH and withdraw management responsibility from water user committees. The evaluators met several municipalities, which were about to sign management contracts with private sector operators for FPMH. In one of the municipalities visited, the levy to be paid to municipalities is a set fee based on an estimation of the number of clients.[108] Municipalities are to assume responsibility for organizing repair facilities and keeping a stock of spare parts.

The result of the drive for more professional management is that the private sector has become increasingly involved in management of water supply facilities. Before private contractors take over management of an AEV or manual pump, the DG Eau and municipalities carry out necessary repairs and renovation. The chosen private sector companies are expected to generate the revenues needed for repair and replacement of water supply infrastructure and also pay tax to the concerned municipality. Whether sufficient resources are indeed available depends on users' willingness to pay for water, the way calculations are made regarding the required fees, tariffs charged and profits that companies are allowed to make. Another factor is how proceeds received by companies for small repairs and by municipalities for major repair and replacement are kept. Municipalities are responsible for selection of capable management companies, for appropriate contracts, monitoring of performance and ensuring that contractual obligations are respected. The DG Eau and S-Eau, with the support of ImS, are expected to assist municipalities and companies in this transfer (Ambs, 2010).

In 2010, data available at the DG Eau suggested that for 165 out of 337 AEVs, a decision on delegation of management was made, contracts for 130 (79%) of these AEVs were signed and delegation of management was actually implemented by 74 (45%) of these AEVs. These are estimations as it was found that records kept by the DG Eau were not always correct (Ambs, 2010). The degree of progress with the professionalization of management varies between *départements*. The process is (almost) completed in Atlantique, Borgou, and Plateau with 93% and more AEVs having delegated management. For the *départements* studied these percentages are 93% for Borgou, 89% for Mono, 67% for Collines (Ambs, 2010).[109] This relatively fast change from 2007 to 2010 is the direct result of a 'trigger', a condition for budget support put into the funding agreement between the World Bank and the government of Benin in 2007. A clear regulatory framework was however not yet put in place.

For the first batch of AEV management contracts, company headquarters tend to be in Cotonou or Parakou, which is relatively far away from where most AEVs are situated. A recent evaluation of experience with the professionalization of AEV management found

[108] In another local government area visited, this change in management was announced but had not yet been implemented. Management committees had ceased to operate, water had become free, and maintenance had been abandoned.

[109] Couffo was not included in the list.

cases of prolonged interruption in water supply due to difficulties in contacting the management companies (Ambs, 2010). The alternative of contracting companies located at the *départemental* or communal level is not happening yet. Administrative requirements (financial guarantee, company registration) make it difficult for these generally smaller companies to qualify.

The above-mentioned recent evaluation of experience also pointed to limited profitability of AEVs in rural areas with a lower population density as a major issue. This is partly explained by limited use of the water facility, particularly during the rainy season. The study recommends that companies would be made responsible for more than one AEV to promote economies of scale, except for remotely located AEVs, which would best be managed by a professionalized AUE in collaboration with the municipality (Ambs, 2010). A further recommendation for enhancing profitability is to bring all hand pumps or foot pumps in the vicinity of the AEV under company management.

Management contracts for water supply facilities are new in Benin, and as a result, little experience has been built up by local companies. Some entered this market out of curiosity (Ambs, 2010). The sites that were visited by the evaluators were 'old' AEVs. Here, the management company continued to employ the operator who was trained by the S-Eau (although in most cases the payment was reported to be reduced). The AEV study found that despite this experience many operators were not sufficiently knowledgeable, for example about the electric wiring or checking filters, which may result in breakdowns (Ambs, 2010).

Findings based on interviews indicate various cases where contractual obligations were not respected (not providing a spare generator, not paying the guarantee, not repairing in a timely way) which was not sanctioned by municipalities. In the AEV cases that were checked at the municipality level, provisions in the model contract that stipulate that the private sector companies should regularly report on technical and financial management to contract partners were not respected. The recently completed AEV study confirms that both municipalities and management firms are faced with many challenges around contracts, but also maintenance, leakages, etc. (Ambs, 2010).

Another issue is transparency of water levy payment. Management companies are to pay a contribution to the municipality for major repairs and replacements and water tax. Concerns were expressed over the justification of the amounts being paid by the companies as the latter may be stating that their costs are higher than they are in reality, impose their ways of calculating the amount of water being sold, claiming high leakages, or demand additional investments from the municipality. Another potential source of conflict is that water measuring equipment is not placed in the presence of municipalities and is not regularly checked by municipalities (Ambs, 2010).

Former members of the water users associations, who are knowledgeable about maintenance requirements, reported that maintenance of the generator was being cut back to reduce costs. This was also confirmed by councillors. Private contractors may seek to reduce operating costs as their contracts are relatively short term, covering a few years only.

In interviews, concerns were expressed that the contractors may count on the municipality and even on the community to step in for repairs in order to re-establish service delivery, even if it is formally the obligation of the private contractor.

Repair technicians for AEVs are available in Benin. The quality of their work is reported to be generally acceptable, but, as also indicated by survey data, it often takes a long time to contact them and to obtain spare parts. Contracts between communities and repair technicians for hand pumps and foot pumps are being promoted by the DG Eau and some municipalities, but are still rare on the ground. The aim of these contracts is to ensure regular maintenance, instead of emergency repair, and better payment for reparation technicians so that they will stay in the profession.

Water user committees and associations

For the communities and water user committees, the new strategy has far-reaching implications. Building community engagement was the strategy pursued for ensuring sustainability of results for many years. According to 1996 legislation, the S-Eau was to sign a convention with the water user associations (AUE) to hand over all infrastructures, except for the water producing unit itself, which remains government property. Communities were asked to contribute to the costs of installing the infrastructure[110] and communities were reported to have presumed ownership. An increasingly refined and harmonized strategy around demand-led planning of investments, installing, managing and maintaining water points emerged. As a result, hundreds of water user associations were set up and assisted in building financial reserves to cover the costs of maintenance and repair work. Members have been trained for years by the S-Eau and by NGOs, supported by donor agencies. The S-Eau worked directly with these community management committees. Social intermediation (ImS) in communities was part of the strategy since 1992 to build sustainability of the water supply facilities. It was used by the S-Eau to accompany requests for new water points and establish local management structures.

This situation started to change when municipalities were established and became responsible for drinking water supplies (Ambs, 2010). Since the municipalities started functioning, the interviewees on the water management committees reported that they had been sidelined and overruled. In their perception, a process of 'centralization' of decision making is taking place with respect to water service delivery. The role of water user committees and associations in sustaining services is diminishing.

The professionalization strategy to enhance financial sustainability is a second factor that influences the role of water user committees and associations. When a municipality has delegated AEV management to a private sector company, the AUE is obliged to hand over its financial reserves to the municipality. These are to be used to pay for repairs and replacements of water supply infrastructure before the selected private sector company

[110] The local contribution was paid for by individuals, by local community associations, such as the local cotton growing associations, or sometimes by a local philanthropist, or by politicians.

takes over. There is frustration at the community level over this 'taking away' of the savings accounts kept by the former committees. The sums can be significant (several million FCFA). Savings were reported to be used to acquire or repair community level infrastructure (mostly for water provision, education, and health). Some AUEs complained that their property (tubes, taps, etc.) was handed over to a private company without consultation or compensation.

Professionalization is not only promoted to increase financial sustainability. During the review process of the first national rural drinking water strategy, the perception prevailed that management tasks have side-tracked these civil society organizations from their primary responsibility; that is, protecting the interest of the water users by monitoring the quality of water and the regularity of service delivery. In this view, professionalizing the management of the facilities is expected to clarify the roles and responsibilities of water user committees (DG Eau, 2010b; Kpatchavi, 2009).

Therefore, water user committees will be replaced by organizations of consumers, the Associations des Consommateurs d'Eau Potable (ACEP) (Kpatchavi, 2009). These consumer organizations can fully concentrate on protecting the interest of the water users by participating in the decision making on the contract and monitor performance. The consumer organizations are to work with the water committee which is to be set up in each municipality council. A water committee exist at municipality and *départemental* level in Collines. The latter have been set up as part of the AFD supported programme. However, in the municipalities visited by the evaluators no water consumer organizations were found and also no comité d'eau in the other *départements*. The establishment of consumer organizations was also not actively supported by the municipality, ImS or S-eau.

Social intermediation (ImS) NGOs

Before the shift in responsibility from communities to municipalities, the expected functions of ImS NGOs were to complete applications by communities for new water points, to mobilize funds from communities, to build management capacity and to improve hygiene practices. Since then, the position and role of social intermediation NGOs has changed and has become less relevant for sustaining services. Increasingly, ImS NGOs are contracted to facilitate the handing over of water point management from water user committees to private companies, and assisting municipalities in developing new relations with communities over service delivery for drinking water (and other basic services). They also play a role in monitoring strategy implementation and data collection. Interviews held with informants of ImS NGOs indicate that setting up water users committees and strengthening accountability of the municipality to users is not part of their work plan.

Currently, the responsibility for social intermediation is handed over to municipalities, which contract NGOs to help implement the new strategy. ImS NGOs are contracted by municipalities, using resources provided by donors (PPEA, PEP or AFD). There are differences between *départements* in ImS as approaches vary between donors. Efforts to harmonize are undertaken at least within departments and also via PPEA. The capacity

of ImS NGO staff also varies across municipalities, which was partly explained by tender procedures not having been followed correctly. Although being paid and supervised by municipalities, they are briefed and trained by the S-eau. The future role of ImS structures will depend on whether the municipality will continue to give priority to the soft policy components and if so, whether the related tasks will become the responsibility of municipality staff, or contracted out to the private sector.

Water authority (water directorate and *départements*)

The (rural) water authority (the DG Eau and its deconcentrated S-Eaux) is responsible for monitoring and enforcing policy guidelines, regulations, standards, quality control and ensuring sustainability of service delivery.

To support strategy implementation rules, control systems and manuals have been developed, training and workshops have been organized, monitoring systems have been developed and an annual review of the sector programme is undertaken. Control systems for tender procedures and assuring quality of installations are in place.

External technical assistance still plays a major role in ensuring control on compliance with rules and technical specifications of works, a role that is being phased out and taken over fully by the DG Eau. Control systems for tender procedures are reported to be currently not sufficiently applied and enforced to ensure prevention of corruption practices, particularly in procurement of services for rural water supply infrastructure through decentralized contracts. Audits are undertaken but were reported to concern only about 5% of all water supply facilities. Such shortcomings may increase costs and reduce technical quality of installations. A number of informants stressed that when problems arise, the solution is often to formulate additional rules, which are subsequently often neither applied nor enforced.

Findings at local community and municipality level indicate that the role the rural Water Authority currently plays in supervising and ensuring sustainability of service delivery is limited. At the same time the water authority is losing experience as most permanent staff members, having been recruited before 1985, are now retiring from the public sector. Some have become active in the private sector. In 2004, the water authority deployed a total of 270 staff – 106 at the central level and 164 in the *départemental* services – and 71% of all employees were contract staff. In 2009, 243 staff were employed, half of whom belong to the highest category (A and B). The percentage of women was 16.5% (mostly B and C).

Ministry of Finance

The role of the ministry in charge of public finance in the water sector has expanded as it is handling a growing share of external resources made available by donors, including funding for rehabilitation of rural water supply infrastructure. The Ministry of Finance is therefore playing an important role in achieving targets and sustaining infrastructure. As reported in Chapter 2 under-spending of planned budgets has been a problem since 2005 (see table 27),

although in absolute terms the sector continued to spend more. The inability of the sector to spend resources available for investment in water (and in other sectors) on time is partly explained by long delays in completing procurement and financial procedures for allocating funds, justification and disbursement (Hadonou and Lambrecht, 2009).

Bottlenecks in communication and coordination within sector ministries, with the ministry of finance and within the ministry of finance, and between municipality, *départemental*, regional and central levels were reported. Procedures for public finance management may not be well understood, not anticipated or not adhered to by water and sanitation authorities. The delays in the financial circuit result partly from challenges at the regional level with respect to coordination between the water authority, the prefecture, and the ministry of finance. There are also difficulties with coordination between the different branches of the ministry of finance, and between the central and sub-national levels. Sector ministries and their authorities (the DG Eau and the DHAB) were reported to be less active than the municipalities and companies in following up requests. The Ministry of Finance is reported to have started assisting both the water and education sectors with their funding requests as funding is fully guaranteed by donors.

Municipalities and private companies similarly experience difficulties. They were reported to have entered into the habit to regularly visit the Ministry of Finance in Cotonou to follow up on their request for fund allocation or payment, respectively. Informants of private sector contractors reported constraints related to lengthy tender procedures, limited technical expertise of concerned government staff at different levels, the obligation to pre-finance operations and the need for active follow-up of invoices to be paid. Some operators were reported to be reluctant to engage with the public finance system, given these onerous procedures for disbursements and securing payment for services rendered. Currently, only private operators with sufficient financial reserves can work for the public sector as the payment delay can amount to several months.

Table 31: Funding available for water infrastructure

	2004	2005	2006	2007	2008	2009
Total credit available billion FCFA)	10.8	14.3	15.4	21.76	20.95	16.69
Financial spending of credit	109.5%	55.1%	45.6%	41.9%	50.2%	63.84%
Total credit spend (billion FCFA)		7.88	7.02	9.12	10.52	10.56
Part of credit managed at departmental level	-	18.2%	29.46%	23.4%	40.76%	40.72%
Length of tender period at departmental level (days)	-	120	86	158	151	150

Source: DG Eau, 2007; DG Eau, 2009; DG Eau, 2010a

Donors

Harmonization of donor support and alignment is pursued in rural drinking water supply in Benin since the 1990s and was broadened in 2002 when a sector-wide output-oriented budget was introduced. An increasing number of donors, including the Netherlands and Germany, have increasingly harmonized and aligned their support with the national policy and systems. Through policy dialogue and monitoring of agreed indicators donors have influenced policy and strategy development.

Expansion as well as rehabilitation and replacement of rural water supply infrastructure requires additional resources, either internally or externally. Funding has relied and continues to heavily rely on donor funding. Commitment to assist until 2015 is still significant, but the system of allocating funds and making these actually available is lengthy and structures and checks to ensure legitimate transfers, payment and quality of works are still underdeveloped.

Donor agencies have played an important role in increasing the capacities of government and NGOs and providing support to oversee and check the compliance and quality of processes through project-based technical assistance. As reported in Chapter 2, and Section 3 of this chapter, technical assistance by donors to build capacity and help the water authority to ensure compliance with rules and regulations has been cut back. However, as indicated in previous sections, the necessary structures, capacities and checks are not yet sufficiently in place.

4.5 Cost recovery and financial arrangements

Evaluation question 27: *Are costs recovered and are adequate financial arrangements for sustaining interventions made?*

The principle of cost recovery (l'eau paie l'eau) is partly realised. As reported in Chapter 3, most improved water points collect water fees. Fees vary, however, across localities and are not always paid. There are no specific provisions for ensuring access of the poorest categories in a community to safe drinking water. Given the current payment structure and water revenues, availability of funds for maintenance and small repairs seems to be ensured (at least from a financial point of view), but cost recovery of investments is not. Decision making on the price of water and percentages set aside for maintenance and replacement of water supply infrastructure, water tax and profit for management companies is still mostly arbitral. Low profitability of water facilities management by companies is a reported concern in some localities. Contribution of management companies to a municipality fund for replacement of infrastructure is expected to enhance financial sustainability. However in view of the limited cost recovery it is unlikely that municipalities can set aside sufficient funds for replacement of infrastructure. Moreover, at the time of the study it was not clear if the funds set aside by municipalities can be protected from 'alternative use'. More generally, and in the long run, it is questionable anyhow whether a strategy of ring-fencing funds for certain purposes is still compatible with an efficient public financial management system of a municipality in a devolution setting.

The recovery of costs is an important element of sustainability in the rural water sector. Data from the impact evaluation surveys indicate that payment is required at 97% of public taps and 80% of the manual pumps. In some cases, other types of payment were reported (e.g. periodic payments or individual lump-sum contributions). It has been a significant cultural change that people in rural areas accept that they must pay for water.

As reported in Chapter 3, per year, about 16% to 34% of improved water sources however do not collect water fees from every household every time. About 20% to 30% of water containers collected from a water point are not paid for. Given this payment structure, cost recovery of investments seems to be implausible, whereas maintenance/reparations seem to be guaranteed (at least from a financial point of view). As reported, an additional issue is that the buying of drinking water from an improved source is not constant throughout the year, putting pressure on the profitability of facilities. Particularly in Collines and Borgou, most AEVs hardly sell any water during the rainy season.

According to the current rural water supply strategy, every manager of a water point is to set a water tariff that covers all recurrent costs of water production, services, monitoring, maintenance and rehabilitation. For AEVs, the cost of water is influenced by the source of energy used for the generator, electricity being the cheapest. In practice, municipalities play a growing role in setting the tariff for water. The fee that can be charged is included in the management contracts. Informants of municipalities expressed preference for a uniform price within the municipality area, including some cross-subsidization.

Various informants stated that, at present, decision making on the price of water and percentages set aside for maintenance, renewal, water tax and profit for the company is not based on a comprehensive calculation of costs. As far as calculations have been made, these do not take into account risks such as unexpected technical problems or mismanagement, and may therefore prove to be too optimistic. Donor agencies were working on systems that would allow municipalities to decide on tariffs and percentages of revenues to be paid by management companies on the basis of repair costs, replacement of equipment and tax level. These systems also show the balance between costs and profitability of facilities (TA Danida and Antea).

For the poorest 40% of households, water fees would constitute about 3% to 7% of their yearly income (see Chapter 3). All actors interviewed at the local level (municipalities, user committees, the DG Eau and NGOs) stated that the current water tariffs were not a barrier to access, not even for the poorest households, although the latter may buy water only for drinking. There are therefore no specific provisions for ensuring access to safe drinking water for the poorest categories in a community. All actors interviewed at the national level however disagree with this local perception.

Financial sustainability of water supply will improve if indeed municipalities set aside sufficient funds and protect them from 'alternative use'. The latter is a concern for staff of many of the municipalities interviewed and for water consumers. One potential problem is that mayors tend to see the revenue generated by water points as general income for

the municipality, without giving sufficient attention to the problem that, within the water sector, they need money to cover the cost of major repairs, replacement and salaries for monitoring the contracts (Lambrecht, 2006).

A potential area of conflict is becoming apparent here between the objective of achieving sustainability in the water supply sector on the one hand and efficient public financial management of the municipality being responsible for a whole range of public services on the other. While in a functioning system of PFM it makes little sense to ring-fence funds in single pots for every single purpose, it might very well make sense to do so in a setting in which a smoothly functioning PFM system on the municipality level is not in place and consumers have to fear that water fees are spent for other purposes without any future municipality revenues from other sources being in sight which could be used for water supply maintenance or re-investment.

Against this background, the differing views on how water fees should be handled by the municipality can be regarded as a reflection of the still on-going devolution process. This is the most likely explanation as well for the conflicting advice which is being given to municipalities on how to administer these water funds (a similar situation was reported by Ambs, 2010). Some staff at the Ministry of Finance in Cotonou suggest that a special municipality bank account with multiple signatures is the best way to keep water funds and ensure availability when required. However, in some *départements*, this option has been declared illegal by other staff from the Ministry of Finance, arguing that this is contradictory to legislation on public finance management. Municipalities were advised to create a special budget line for 'water fees'. The disadvantage of this option is that when difficulties with liquidity are experienced at the central or municipality level, it will be hard to mobilize funds at short notice for major repairs or renewals (see also HAADI, 2008 p. 15).[111]

A final concern regarding financial arrangements in the sector is transparency of resource use. In the communities visited local respondents reported not knowing what happens with the funds set aside. Several informants from the municipalities expressed the need for more systematic financial auditing. Regular financial auditing of the municipalities is rare (sometimes only once in five years) and is not taken into account in existing legislation. New legislation may still take several years. FADeC however imposes an annual audit, organized by the Ministry of Decentralization and the Ministry of Finance.

4.6 Other factors affecting sustainability

Evaluation question 28: *Are there other factors that affect sustainability not captured under question 24 to 27?*

Other factors that may affect sustainability and are not sufficiently in place are environmental factors and some further factors related to governance. Ground water availability is becoming an issue and arrangements for monitoring and addressing environmental aspects are underdeveloped. With an

[111] Experimentation with communal water funds is ongoing for several years by NGOs such as PROTOS.

increasing number of actors in the water sector, coordination between actors and levels becomes more important. Initiatives to this end are taken, which helps to build trust and accountability and to take actions to better sustain services. Organizations of users/consumers of water are however hardly emerging and NGOs that could support user/consumer interests are generally weak. Women play an important role in collecting and paying for water but their participation in rural water supply structures is low. The evaluation team has not come across special initiatives to engage women either in water user committees or in management functions as part of the professionalization strategy. Monitoring systems are in place at national and regional level, but these do not capture local processes and bottlenecks that may undermine the sustainability of beneficial impact.

Environmental factors

A lack of groundwater can make it impossible to install manual pumps, or can render them unusable. This lack may also reduce pressure in the piped water system, resulting in some taps serving water only part of the year, as was reported during the interviews. According to the survey data, 4% of the respondents relying on AEVs and 3% using pumps have no water during the dry season.

Availability is also a challenge in the densely populated coastal zones due to salt water infiltration. In parts of the centre and north of Benin it is difficult to locate suitable groundwater reservoirs, increasing the costs of drilling. The replenishment of groundwater levels is expected to become an issue in the north of Benin, a situation represented by the department of Borgou, the most northerly *département* in the survey (Barthel *et al.*, 2009). Improving the availability of groundwater at the level of watersheds is one of the aims of integrated water resources management.

Monitoring water levels in rivers is becoming an increasingly important task for the DG Eau. Arrangements and capacity to address such environmental issues are still underdeveloped. Legislation and policy on water has been in preparation since 2005 and foresees the creation of agencies for the larger watersheds in Benin. Another focus is protecting surface water sources that are important for drinking water.

Coordination and accountability

Coordination between organizations and across levels has become increasingly important. For example, a chain of parties is involved in designing water supply facilities, construction and quality control of works at the central, *départemental* and municipality level. Coordination is becoming even more important following the growing engagement of municipalities in the sector and the spread of public-private contracts. Coordination can be important as a means of enhancing accountability between decision-makers, service providers and users, which can help to build trust and positively influence the quality and sustainability of service delivery (World Bank, 2003).

At the *départemental* and regional level, various initiatives have been taken to promote coordination around water and sanitation. In Collines, monthly meetings are organized

at municipality and *départemental* level, which bring together all actors. Water user organizations are not invited. Elected councillors are expected to represent consumers' interest. Water and sanitation is also discussed at regional-level meetings organized by the prefecture. In addition, NGOs such as PNE, are setting up water fora on integrated water resources management, also at the regional level.

Although the establishment of consumer associations is part of the revised strategy, the evaluation team did not meet such new associations in the communities visited, as indicated earlier. Initiatives to ensure that consumers are heard and that their interests are taken into account have been limited up to now. Overall, civil society organizations remain rather weak and cannot exert much influence (MDEF, 2006).

Nonetheless, there were reported cases of (former) water committee members being active in monitoring new management contracts; of clients of AEV's calling upon the mayor and other municipality staff when a water supply is interrupted; and of municipalities responding. There is no experience yet with privatization of manual pump management and thus whether manual pump clients, who may live more remotely, will be equally active when services do not meet expectations, and whether municipalities will react promptly to their requests.

Local NGOs can also play a role in this type of public debate. However, most NGOs specializing in water related issues have become ImS NGOs. They are acting in fact as private sector agents and are contracted for limited periods and comply with specific terms and conditions. ImS NGOs are increasingly supervising service delivery for the S-Eau and municipalities rather than supporting consumer interests. All those interviewed in the ImS NGOs reported that actively encouraging municipal councils to respect the principles of citizen consultation and accountability was not part of their work plan.

Women's participation and voice

At the level of communities, domestic water supply and hygiene is reported to be mainly a women's affair. Women are responsible for fetching water and can be assisted by their children. Where pushcarts are used to fetch water in containers, boys tend to do this work. During the group interviews held for the institutional analysis, both men and women reported that in many households women were paying for the water from their own resources. Others have to ask their husbands and other relatives for money to buy water. In the survey, female respondents in 50% of the households reported that women are mostly responsible for covering the costs of drinking water. In the case of male respondents, this figure dropped to 16%.

Consultation and participation of women as primary stakeholders in local water user and management structures may help to know and/or address bottlenecks that jeopardize sustainability of services. Women's participation and voice in rural water supply structures at the different levels is very limited, despite much investment in equal participation of women in community level committees. The presence of women in water user committees

and associations is still low, particularly in leadership positions. In committees, women were reported to sometimes be asked to keep the money 'as they are less likely to be bold enough to take away the money'. Both women and men are employed as sellers of water, particularly in the case of AEVs.

The number of female operators is one of the indicators in the objectives-based programme (BPO). The evaluation team has not come across reported specific initiatives to promote women's participation in decision-making around management contracts with private companies, or to stimulate that women also apply for such a contract. One example was quoted of a women's' association that has won the tender for managing an AEV (commune de Sinendé). In Collines, where FPMH were at the time of the interviews being contracted out, there were few cases (reportedly less than 10%) of women signing a management contract with the municipality. Women have been proposed by communities but many did not dare to accept the conditions listed in the management contract. There are targets for having women as operators, but no support was available to assist women to apply.

Monitoring

Although there are monitoring systems in place at national and at regional level, they do not sufficiently capture local processes and bottlenecks and there are no structural arrangements for the follow up of issues that undermine the sustainability of interventions. The scope of data collected by *départements* is currently limited to mostly technical and financial data. Data collection at national level informing donors mostly focuses on indicators for national-level outputs, transfer and utilization of funds, competency and capacities. Moreover, these data are incomplete, not up to date or there are errors in the monitoring data (Ambs, 2010). Municipalities also need monitoring data and for this they rely heavily on ImS NGOs. They mostly lack the capacity to supervise the monitoring and follow-up process.

During the work on the survey, monitoring gaps were experienced first-hand. As reported in Chapter 3 for the planning of the survey, information was needed on progress of construction of planned water points in the sample localities. This type of information is brought together only once a year at the central level of the water authority (DG Eau), in preparation for the annual review. During the year, it has to be obtained directly from the S-Eau at the *département* level. For Mono-Couffo and Collines, information on progress was provided in time, with support of German technical assistance. In Borgou, it took many months to obtain information on actual progress. When the information finally became available, it showed that the gap was very wide. Only one of the 71 planned water points had actually been constructed. Construction of the other planned water points was delayed or postponed to the following years.

The PPEA commissions an external monitoring and evaluation exercise every six months, implemented by an international consultancy firm and a yearly audit. In these cases, the results are discussed with the DG Eau and other development partners as well as all other partners involved in the implementation of the programme.

4.7 Summary and conclusion

The second national strategy for rural drinking water provision shows a changing perspective on ensuring the sustainability of benefits. The approach of developing adherence and engagement of water users in planning, financing, managing and maintaining water points is abandoned, increasingly also for foot and hand pumps. This responsibility is shifted to municipalities, who progressively contract out management services to private companies. These companies have to pay water levies and a contribution for a fund for replacement of water supply infrastructure. Most municipalities having delegated management to private sector companies, no longer involve water user associations. In addition, municipalities have started playing a pivotal role in planning new investments and setting the costs of drinking water.
Following the new strategy, an increasing number of actors are engaged in delivering and sustaining safe drinking water and sanitation services, and improving hygiene. Developments outside the water sector are also important for sustainability, particularly with respect to public finance, deconcentration, devolution and human resources in the public sector. With an increasing number of actors in the sector, coordination between actors and levels becomes more important. Initiatives to this end are taken, which helps to build trust and accountability and take actions to better sustain services.

Survey data analysis shows that the majority of used rural water points in the localities in the sample, still mostly the result of the previous strategy, were functioning at the time of the survey. This is a remarkable result. However a substantial part of improved water sources is abandoned over time, and already within five years. Reported factors that explain discontinuity are: difficulty to get in contact with technicians resulting in delay in repairs, insufficient funds for (major) repairs, lack of spare parts, lack of preventive maintenance, conflicts between different user groupings causing discontinuity after a break down. Also weak planning, design and installation may explain abandonment. Another reported factor undermining sustainability is lack of transparency of financial management of water facilities. A substantial part of abandoned water points has been rehabilitated by government supported by donors.

For the new strategy, an assessment of sustainability may seem premature. Definite conclusions on the sustainability of the new strategy and 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 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.

The current rural water supply strategy is as such clear and accepted by most stakeholders, except for changes in management of water infrastructure, which are controversial at community level and can be a cause of conflict. At this initial stage of implementation of the new strategy, the overall conclusion is that the sustainability of beneficial impact is not, as yet, ensured. An obvious factor is that much of the institutional framework is new and

still evolving. Currently and for the medium term, there are various capacity constraints at the level of municipalities, companies and the water authority, putting sustainability at risk. The technical and financial capacity of municipalities to take up a considerable expansion of responsibilities and tasks is still limited.

Technical quality of investment in physical infrastructure for rural drinking water supply is not fully ensured. Compliance with contracts by municipality is not systematically checked and sanctions are not being applied, partly due to lack of experience of municipalities and companies. Donor technical assistance provided to build capacity and help the water authority and Ministry of Finance to ensure compliance with rules and regulations is being cut back, without the necessary capacities being sufficiently in place. Management contracts for rural water supply facilities are new in Benin and most companies have limited experience. There are also capacity constraints at the level of the water authority (at *départemental* and central level) in supporting municipalities and ensuring sustained services. Government funding of water supply infrastructure, including rehabilitation has been constrained by delays in processing of funds.

The principle of cost recovery (water pays for itself) is only partly realised. Most improved water points collect water fees. Fees vary, however, across localities and are not always paid. If households collected all water they consume from an improved water source they have to spend between 1% and 4% of yearly income for water consumption. For poor households this would be between 3% and 7%, being more than the international standard of 2%. There are no specific provisions for ensuring access for the poorest categories in a community to safe drinking water. Given the current payment structure and water revenues, the availability of funds for maintenance and small repairs seems to be ensured (at least from a financial point of view), but cost recovery of investments is not. Decision making on the price of water and percentages set aside for maintenance and replacement of water supply infrastructure, water tax and profit for management companies is still mostly arbitrary. Low profitability of water facilities management by companies is a reported concern in some localities. The contribution of management companies to a municipality fund for replacement of infrastructure is expected to enhance financial sustainability. However in view of the limited cost recovery it is unlikely that municipalities can set aside sufficient funds for replacement of infrastructure. Moreover, at the time of the study it was not clear if the funds set aside by municipalities can be protected from 'alternative use'. In the longer run, it is questionable anyhow whether such a strategy of ring-fencing funds for certain purposes is compatible with efficient PFM on the municipality level.

The responsible Ministry of Health gives less priority to resource allocation for hygiene and sanitation compared to curative and other preventive health care. Despite the intended systematic inclusion of sanitation and hygiene promotion in the rural drinking water strategy since 1992, this component continues to receive low priority during implementation. Hygiene promotion is taken up by animators, hygiene assistants and technicians at the time that new water facilities are created, but there is no systematic follow up of actions taken, partly for lack of funds for operational costs. Responsible key institutions in rural water supply, DG Eau, water departments, municipalities, are, as

compared to water supply infrastructure, much less attuned to hygiene and sanitation interventions. The contracting out of management of water facilities to companies may make the current community approach to promote improved hygiene practices as part of drinking water development even less effective. Municipalities have relied heavily on ImS NGOs for these components, but roles are changing and it is not clear whether these NGO services will be continued after donor funding stops.

Other factors identified that may influence sustainability are environmental factors and further factors related to governance. Ground water availability is becoming an issue and arrangements for monitoring and addressing environmental aspects are underdeveloped. Organizations of users/consumers of water are hardly emerging and NGOs that could support user/consumer interests are generally weak, as NGOs are shifting their focus towards supporting municipalities on a contractual basis. Women continue to play important roles in collecting and paying for water but their participation in rural water supply structures is low. The evaluation team has not come across special initiatives to engage women either in water user committees or in management functions as part of the professionalization strategy.

At the time of the evaluation, financing in the sector relied heavily on donor funding. The commitment of donors to assist until 2015 is still significant, but the system of allocating and disbursing funds is cumbersome. Structures and checks to ensure legitimate transfers, payment and quality of works and services are still underdeveloped. Inspections and audits were reported to only cover part of works and services. Monitoring initiatives do not give sufficient attention to local processes and bottlenecks and to the follow-up of issues that undermine sustainability of interventions and beneficial impact. The first strategy has resulted in the acceleration of the establishment of water points. The challenge of the second strategy will be to ensure that sustainability is indeed achieved.

Annexes

Annex 1 Terms of Reference

Purpose, rationale and scope of the evaluation

The 7th Millennium Development Goal (MDG 7) aims to 'reduce by half the proportion of people without sustainable access to safe drinking water and improved sanitation'. Improving health is the major rationale for programmes that aim to improve access to clean water and hygiene and hence contribute to achieving MDG 7, save lives, and improve living conditions in rural areas. Improved water and sanitation may also have various indirect beneficial economic effects. Diarrhoea and other diseases transmitted through water may hinder school-age children's physical and mental development and lead to high health costs for households. Reductions in time and energy spent collecting water may generate extra time spent on more productive sectors.

Hence, the ultimate purpose of financing water and sanitary facilities goes beyond increasing access to 'improved' water and sanitation facilities. The intention is to improve the living conditions of the population, and health in particular. The main purpose of this study is to analyse the impact of water supply and sanitation (WSS) interventions in rural Benin on the health and livelihoods of households in Benin. This is done by applying a rigorous methodology which concentrates on attributing changes in relevant indicators (such as water use and health) in the target population to the interventions. Conventional evaluation studies (using qualitative or retrospective approaches) are often not able to quantify this impact in a rigorous way as they often either focus on project outputs (rather than on outcomes and impacts) or use unrepresentative small samples. Most importantly, many conventional evaluation studies are constrained by the fact that they do not allow to separate the impact of specific interventions from other factors that influence the measured outcome. In particular, village level interventions are not allocated to villages at random: it is to be expected that some villages are more likely to receive the intervention because of certain characteristics, e.g. a better-educated or more active leadership. It is also likely that impact indicators such as health status are, on average, better in such villages. The task for the evaluator is to separate the influence of these characteristics from the impact of the intervention. The methodology used in this study allows one to be confident that the impact identified is caused indeed by the intervention. If impacts can be attributed to individual programmes, donors can use these impact results to improve current programmes or to compare the effectiveness of different programmes for further resource allocation.

The rationale of the impact evaluation is to account for the substantial support provided by the German and Dutch development cooperation for WSS programmes in rural Benin as well as to learn lessons that will be useful for WSS policy development in the future. In cooperation with other donors, the Dutch and German development cooperation have supported the water and sanitation programmes of the Government of Benin since 2004 and 1998, respectively. The interventions to be analysed in this study include those carried out under major programmes in the water and sanitation sector such as PADEAR (Programme d'appui au développement du secteur de l'eau et de l'assainissement en milieu

rural), PADSEA (Programme d'appui au développement du secteur eau et assainissement), PEP (Programme Eau Potable), and, more recently, the PPEA (Programme pluriannuel d'appui au secteur de l'eau potable et de l'assainissement). German support for investments in water and sanitation programmes in Benin is EUR 8 million annually on average and has been ongoing for ten years, complemented by technical assistance (GTZ–DED, about an additional EUR 2.5 million per year). Programmes supported include SONEB (urban water supply) and PADEAR (support programme for development of the rural water and sanitation sector). Dutch support is channelled through the PPEA, which runs from 2007 to 2012 and has a total value of about EUR 50 million.

The study further aims to evaluate the accuracies of different quantitative methodologies for future impact evolutions: difference-in-difference analysis, pipeline approach, cross-sectional studies and retrospective approaches. The trade-off between those methodologies is accuracy versus implementation costs. For the efficiency of further impact evaluation it is important to quantify these trade-offs using the same dataset.

The scope of the study is as follows. The interventions studied are the provision of rural drinking water infrastructure and sanitation and hygiene promotion (including construction of latrines). The study will use survey data. To estimate the effect of interventions, two rounds of data collection are planned.[112] A baseline survey will be organized before interventions are realised in treatment and control localities and after the realisations, data will be collected again in the same households. Using these survey data, the study aims to quantify household-level effects of interventions implemented at the level of the locality. The study will cover the period 2008 to 2010.

The *départements* where the impact study will be organized are Mono and probably Couffo (depending on the availability of administration data, which will be found out during the pilot study in December) in the south, Collines in the centre and Borgou in the north-east. Using a large sample across different regions in Benin, the impact study aims to conclude about the general impact of WSS interventions in rural areas in Benin. The main indicators reflecting primary effects of water interventions are the quantity and quality of water used by households and the change in the amount of time spent on water collection. The study also analyses secondary effects, measuring different health outcomes, reductions in health costs and number of days being ill.

The study is initiated and financed by the respective evaluation departments of the Netherlands Ministry of Foreign Affairs (IOB)[113] and the German Federal Ministry for Economic Cooperation and Development in association with the German development bank KfW. The study will be undertaken in consultation with Beninese partner

[112] In each round we will conduct two surveys: one in the dry season and a smaller one in the rainy season.

[113] The Policy and Operations Evaluation Department (IOB) of the Netherlands Ministry of Foreign Affairs has initiated a series of impact evaluations of support to programmes for water supply and sanitary facilities. Previous impact evaluations in this series have studied the impact of Water and Sanitation programmes in Tanzania and Yemen. Other studies are underway in Egypt and Mozambique.

organizations and authorities, particularly the DG Eau and the DG HAB, the Netherlands Embassy and the German development cooperation in Benin.

Background and context

Benin is a poor sub-Saharan country. The 2005 population is estimated at 8 million with an average annual growth rate of about 3.2% (World Bank, WDR 2007). The mean daily per capita income is (PPP) is USD 3; the per capita GDP growth rate for 2004–2005 was 0.7%. The dollar-a-day poverty rate estimate for 2003 was 31%, the two-dollar-a-day poverty rate is estimated at 74%. The country stretches in north–south direction between the River Niger in the north and the coast (Bight of Benin) in the south. Population densities are relatively high in the south; villages and localities are more dispersed in the northern regions.

Water and sanitation programmes in rural Benin provide, as in most developing countries in sub-Saharan Africa, mainly community-level water infrastructure (the exceptions are villages located close enough to an urban agglomeration, allowing them to be connected to the urban piped network), as well as public latrines (mainly in schools) and hygiene education and promotion. Having two rainy seasons (from April to July and from September to November), Benin has relatively few problems in the provision of sufficient water quantity. To the north of the country, people do however face water quantity constraints and inappropriate water quality is still an issue throughout the country.

Policymakers in Benin adopted a national strategy for drinking water in rural areas in 1992, which emphasized local participation in the process of installing, operating and managing the infrastructure so as to ensure sustainability which was found to be lacking in previous programmes. Keywords in the process were deconcentration (delegation of authority to local-level state authorities) and decentralization (transfer of competencies, power and resources to elected local bodies with participation by end users). As a result, one nowadays observes a system which is – at least in theory – demand-driven: groups of end users formulate a demand for water infrastructure (assisted by NGOs)[114] and, with technical assistance from *départemental* water services (authorities), these demands are translated into formal applications which translate into water interventions in the form of water pumps or community pipes. After construction, households using the new water source have to pay between FCFA 0.5 and FCFA 1 per litre. The idea is to create local ownership of water supply infrastructure as well as to build up some reserve funds so as to directly address the problems of maintenance and sustainability.

While the implementation practice of the WSS programmes differs from one *département* to another (and, to some extent, from one donor to another), the main elements are fixed. In rural areas, the core programme elements provided are: water infrastructure of various types; hygiene education and hand washing promotion; public latrine building and promotion of private latrines (recently with cement subsidy). Sanitation interventions – in theory – follow water infrastructure (the argument is that hygiene promotion makes no

[114] This demand for water infrastructure includes a fund of about EUR 200 to be paid by the village.

sense when water is not available) so that one rarely finds localities with only a sanitation programme.

The administrative unit targeted by water and sanitation interventions is typically the *localité* which should be thought of as a distinct village part or neighbourhood. The different *localités* that make up one village can be located far apart. In general, travelling from south to north, village and locality populations become more dispersed. The administrative organization of Benin is described in Table 1.

Table 1: Administrative organization of Benin

Structure	Number	Status	Authority	Description
Départements	12	Administrative unit (Circonscription administrative)	Governor (Préfet covers two provinces)	Nomination by Council of Ministers
Communes (Municipality)	77	Decentralized territorial unit (Collectivité territoriale décentralisée)	Mayor (Maire)	Elected in 2003 and 2008
Arrondissements (Former municipality)	546	Local administrative unit (Unité administrative locale)	Chief (Chef d'arrondissement)	Election in 2003/ 2008
Villages	3741	Local administrative unit (Unité administrative locale)	Village chief (Chef de village ou de quartier)	Elected since 1990 by villagers
Localités	23435	Lowest administrative unit	?	

Source: DGIS–IOB, 2007, Benin Country report; Census 2002; and DG Eau data

Table 2 shows estimates of the percentage of households with access to various types of water sources and improved sanitation in Benin. The evidence of the progress made of the various WSS programmes is mixed. Water constraints are less severe in Benin than in other SSA countries, with an average rural access to 'improved water sources' of 47% in 2006. Nevertheless, progress in recent years appears to have been rather slow; use of non-improved water sources in rural areas remained stagnant between 2001 and 2006. Sanitation infrastructure coverage in Benin is very low and, again, almost no progress has been made within the last couple of years; [115] 62% of all households and 82% of rural households still indicate not using any sanitation facility.

[115] Unfortunately we do not have any information about changes in hygiene knowledge and/or education.

For comparison, using the definition of the United Nations, in 2004 access to improved water was at 67% in Benin and 33% of the population were using improved sanitation facilities. In the rest of sub-Saharan Africa, only 56% did have access to an improved water source, but 37 had access to improved sanitation (UN Development Report, 2006).[116]

Table 2: Water and sanitation in Benin and SSA

	Total country			Rural		
WATER BENIN	**1996**	**2001**	**2006**	**1996**	**2001**	**2006**
Piped into dwelling	26	33	32	8	12	13
Public tap	5	13	11	7	18	15
Well with pump	14	11	14	21	16	20
Protected well	9	5	8	9	6	9
Unprotected well	23	19	20	22	23	24
Open water	23	18	15	33	25	20
Improved water source	45	57	57	36	46	47
UN: improved water source			67			
SANITATION BENIN	**1996**	**2001**	**2006**	**1996**	**2001**	**2006**
Flush toilet		3	4		0	0
Ventilated latrine		16	18		5	12
Unventilated latrine		16	16		10	6
No facility		65	62		84	82
Improved sanitation		35	38		16	18
UN: improved sanitation			33			

Source: Own Calculations based on Demographic and Health Surveys (DHS) 1996, 2001, 2006; UN statistics: Human Development Report (2006)

The most recent WSS programme formulated by the Government of Benin is the Programme pluriannuel d'appui au secteur de l'eau potable et de l'assainissement (Multi-annual drinking water and sanitation programme) or PPEA. This programme, which runs from 2007 to 2012, will continue to develop water and sanitation infrastructures while emphasizing decentralization, capacity building and local 'ownership'. The infrastructure planning standard is that one equivalent point d'eau (EPE, equivalent water point) serves 250 people and apparently this number is sometimes used to calculate coverage (% served) even if actual use is lower than 250.

[116] Note that the definition of improved water and sanitation might be slightly different in the Human Development Report (2006) than the definition we used when analysing the DHS surveys.

Table 3: Realised and planned water infrastructure							
	Realised water projects						
	2002	2003	2004	2005	2006	2007	2008
Rural population (million)	5.6	5.8	6.0	6.4	6.6	6.9	7.1
% 'served'	42	41	42	42	45	52	57
New EPE	386	524	892	761	1339	2341	1978
Rehab EPE	55	52	187	139	422	802	864
Total EPE	441	576	1079	900	1761	3143	2842
	Planned water projects						
	2009	2010	2011	2012	2013	2014	2015
Rural population (million)	7.4	7.7	8.0	8.3	8.6	8.9	9.3
% 'served'	63	68	71	74	76	79	81
New EPE	2038	1885	1805	1925	2016	2167	2297
Rehab EPE	844	694	639	668	678	680	683
Total EPE	2882	2579	2445	2593	2694	2847	2980

Source: DG Eau data

With this caveat, Table 3 presents data on realised EPE installations between 2002 and 2008 and planning of water infrastructure for the period 2009 to 2015. Table 3 also shows that a dramatic expansion of rural water infrastructure is planned in Benin. If these plans are realised the share of the rural population 'covered' by new or refurbished EPEs will increase from the current level of 57% to 81% in 2015. This expansion entails the installation of around 2000 new EPEs (and 600–700 refurbished EPEs) each year between 2009 and 2015.

Theory and objectives

This impact study is based on a policy framework (theory) which is described in, e.g., World Bank-IEG (2008). This general framework describes the logic by which the interventions are expected to affect the desired outcomes. A slightly adapted version of this framework is reproduced below and aims to illustrate the cause and effect links envisaged.

Table 4: Policy impact framework				
Inputs	**Activities**	**Outputs**	**Outcomes**	**Impact**
Budget support and TA for water infrastructure	Village-level provision of water infrastructure and institutional support	Functioning of improved water sources	Higher water quality, quantities and reduced travel time Higher proportion of households using improved water sources	Better health, higher educational attainment, improved livelihoods, gender equality
TA to promote hygiene	Promotion of knowledge and behavioural change with respect to hygiene	Change in water use practices	Better water quality at point of use	Better health, higher educational attainment, improved livelihoods
TA to promote sanitation	Promotion / subsidization of sanitation facilities	Increased number of sanitation facilities	Use of improved sanitation facilities	Better health, higher educational attainment, improved livelihoods, gender equality

Source: Adapted from World Bank–IEG, 2008, Figure 3

The links in the causal chain indicated in Table 4 are far from automatic. Causal chains may be disrupted in one or several of the columns depicted. For example, a new village pump may not be used because traditional sources are preferred; and even if it is used, it may not lead to improved drinking water because of contamination during household storage; even if water quality in the household improves it may not lead to improved health outcomes without hand washing. The causal links depicted do, however, lead to hypotheses that will be tested by this study.

The main and general hypothesis to be tested in this study is that certain *activities* have a positive causal effect on *outcomes* and *impact*. This is a 'yes/no' question: did the intervention (=activity) lead to the envisaged positive effect and what was the magnitude of this impact? A second focus of this study is to answer the more difficult 'why' question: why, or under what circumstances, do the interventions result in the envisaged output and impact?

A number of factors related to the 'why' question are addressed in this study. First, the distinction between community-level and household level provision is important. There is 'compelling evidence' (Zwane and Kremer, 2007) that household piped water infrastructure reduces child mortality, mainly through reducing diarrhoea. However, a critical review of the literature suggests that there is 'little evidence that providing community-level rural

water infrastructure substantially reduces diarrhoeal disease … or that this infrastructure can be effectively maintained' (Zwane and Kremer, 2007). World Bank IEG (2008) agrees that 'community standpipes … do not have significant health benefits, though they do produce time savings'. The main argument made is that point-of-use water quality (in the household) is often not affected by improved community-level water provision, since inappropriate water storage at the household level may lead to contamination of otherwise clean water.

Water infrastructure provision in rural Benin is predominantly at the *localité* or village level, that is, village-level piped water (AEVs) on the one hand and locality-level pumps on the other hand. For the present study, this means that the impact of water interventions on the water quality at the point of source as well as at the point of use will be studied.

Furthermore, epidemiological studies (Cairncross and Valdmanis, 2006) have emphasized the important distinction between water-washed transmissions of diseases (associated with a limited quantity of water available for domestic hygiene, e.g. hand washing in the household) and waterborne transmission of diseases (associated with poor water quality). For the present study this means that both the change in water quality and quantity used will be recorded and the association with various types of diseases will be analysed. Several studies have also reported the importance of hand washing and point-of-use treatment to be very effective interventions for reducing water-washed diseases (World Bank–IEG, 2008), which will also be a focus of that study in relation to water interventions.

As for sanitation interventions, World Bank IEG (2008) reports that evidence is very limited but that existing studies do not indicate that the impact of clean water (infrastructure) on health is enhanced by sanitation. That is, while there is some evidence that providing either programme has a positive health impact '… the total impact is not increased by combining the two'. In contrast, Esrey *et al.* (1991) and Esrey (1996) claim that improvements in sanitations have an even greater impact on children's health and mortality than improvements in water access while improvements in water might even be mitigated by bad hygiene conditions (e.g., when human excreta are discharged into otherwise clean waters). The complementarity between water and sanitation interventions will hence be a further focus of the present study. As of today, many studies analysing the impact of water and sanitation investments still suffer from methodological shortcomings (Zwane and Kremer, 2007) and there appears to be scope for additional empirical evidence on the impact of WSS interventions on health and well-being (e.g. reducing the workload of women).

The main objective of this study is hence to identify quantitatively, at the level of localities in Benin between 2008 and 2010, the effect of the WSS programmes on water quantity and quality used by households (at point of source as well as at point of use); on time for collection of water (outcome indicators); on selected health impacts; and on selected livelihood impacts (education by gender, health costs, number of days being sick, etc.).

Furthermore, the study will seek to identify factors that explain variation in outcomes and impacts (i) conditional on project implementation (such as type of water infrastructure, maintenance support, water costs, additional hygiene promotion) and (ii) conditional on factors not related to project implementation (such the seasonal variations, socio-economic status or alternative water sources). Last, applying different methodologies this study will also compare different evaluation techniques which will help to improve impact evaluation studies in the future.

The study also aims to give an up-to-date qualitative description of the water and sanitation sector in Benin, the role of the donors and of the institutional arrangements. This description first serves as an introduction and background for the quantitative impact analysis. It also provides in-depth information about causal chains of WSS interventions to be tested in the quantitative study and important hints for the interpretation of these quantitative results.

The wider aim of the study is to inform policy makers and practitioners in Benin, in particular those in the water and sanitation sector, to provide lessons for improving development results of PPEA, PADEAR, PEP, PADSEA and other water and sanitation programmes in Benin (and, maybe, elsewhere).

Evaluation questions

The study will comprise two parts. The first (qualitative) part addresses questions 1 to 14 and establishes the facts concerning the problem, context, key inputs, and outputs. The second and major part of the study (quantitative) is concerned with outcome and impact variables and addresses questions 15 to 30.

Context

1 How has the national institutional and policy context for domestic water and sanitation evolved in Benin since the 1990s?
2 What has been the water and sanitation situation at the beginning of the project?
3 What has been/is the health situation in Benin and what other programmes (besides WSS interventions) have targeted the health situation of the population?

Project description and institutional analysis

4 What have been the objectives of WSS programmes in Benin (PADEAR, PADSEA, PEP, PPEA)?
5 What approaches/ strategies were adopted in order to meet the objectives?
6 What were the main interventions that have been undertaken by the WSS programmes?
7 What were the objectives at the beginning of the programmes?
8 How have the programmes' strategies influenced the character and performance of drinking water and domestic sanitation institutions?
9 Are institutional structures and roles with regard to domestic water and sanitation clearly defined, understood and fulfilled?

10 To what extent do current institutional arrangements provide potential for user participation in the planning, operation and maintenance of domestic water and sanitation services?
11 What lessons does Benin's institutional experience in domestic water and sanitation offer for national policy and institutions?

Output

12 Were the infrastructure targets for water and sanitation achieved?
13 What are the main determinants of output quality (technical, institutional, economic)?
14 What has been the trend in the cost of service delivery?

Outcomes

15 What has been the change in the proportion of the population with access to an improved water source and what is the proportion actually using it?
16 What has been the change in the quality and quantity of water provided and consumed for drinking water and hygiene purposes?
17 What has been the change in the time used for collection of water?
18 Is there a reduction in the use of alternative water sources?
19 Are there any differences in water quantity and quality for the rainy and dry season?
20 What has been the change in the access of the population to an improved sanitary facility?
21 What has been the change in hygiene knowledge and practices?
22 Are there differences across socio-economic groups and gender with regard to the outcomes measured above?

Impact

23 How do customers perceive the quality of water interventions and services?
24 What have been the effects on water related disease incidence of the population?
25 What has been the change in numbers of days sick for the population?
26 Has there been a reduction of health costs for the population?
27 Is there an increase in school enrolment (especially for girls)?
28 Is the positive impact of water enhanced by sanitation interventions and hygiene education?
29 Which water interventions work best with regard to health impacts and why?
30 Have there been positive or negative unintended effects?

Quantitative study: Methodology, research design and data sources

Methodology

The quantitative part of the study essentially consists of a **difference-in-difference** (DD) impact estimation in combination with a **pipeline approach**. The main characteristic of DD impact estimation is that it analyses data that were collected before and after an

intervention in both treatment and non-treatment localities.[117] This allows controlling for unobserved differences across space as well as time. The sample should therefore include both localities that will be treated (T) in the time period considered and those that will not be treated (C) in the time frame considered.

A key requirement for the validity of a DD analysis is that unobserved determinants of changes in the outcome variable of the treatment and control groups are similar'. The sample selection should therefore chose T and C localities such that they are as 'similar' as possible. To achieve a large degree of similarity between T and C we follow a pipeline' approach (Duflo *et al.*, 2006). Treatment localities are identified as those for which a water infrastructure is planned for 2009. Control localities are those for which water infrastructure is planned after or shortly before 2009. The surveys will be conducted at the beginning of 2009 and again at the beginning of 2010 to be able to conduct a difference-in-difference analysis.

The final impact analysis will then be carried out using multivariate regression analysis controlling for time and localities effects and a (large) number of covariates. Combining the pipeline approach and difference-in-difference analysis the study should come very close to the results of a randomized experiment (Duflo *et al.*, 2006).

Add-On: Apart from randomized interventions, which are in most cases not feasible in large-scale officially funded programmes, difference-in-difference estimation is one of the most thorough methods that can be used for impact evaluation. The disadvantage of difference-in-difference estimation is that (1) it requires a (extensive) two-wave panel of data and (2) that data has to be collected before any intervention takes place. Today, retrospective and/or ex post cross-sectional techniques are therefore often used for impact evaluations. An open question is how precise these evaluation techniques actually are. As an add-on it is, hence, proposed that this study conducts both difference-in-difference estimation and retrospective and ex post cross-sectional analysis to compare the two approaches (no additional data is necessary to do this). The study would analyse (1) retrospective questions in the surveys, (2) only using data from the 2010 round (without a difference-in-difference analysis) and (3) DHS data from 2006 (including geographic references for villages) which together with the geo-referenced data on realised water interventions allows us to pursue an ex post (cross-sectional) nationally representative impact evaluation.[118]

[117] Randomized experiments: If we could randomly choose treatment and non-treatment localities, i.e. randomly choose the localities, receiving a water intervention, we would only have to compare treatment and non-treatment localities after the treatment localities had received any water intervention. This is, however, not politically feasible and therefore we have to do a double difference study which requires two surveys based on the WSS planning of localities.

[118] DHS data contain information on water source used, time to water, sanitation, diarrhoeal incidence among young children and under five child mortality. This methodology would probably be a fast and inexpensive approach for impact evaluations in sub-Saharan Africa as DHS surveys are conducted on a regular basis in almost all SSA countries.

Research design

- *Intervention:* The (village/localité level) interventions studied are the provision of newly built drinking water infrastructure; sanitation infrastructure; and sanitation and hygiene education. Out of this, the study aims to identify the impact of water interventions that will be realised in 2009 at the level of the localities. Since these programme elements have not (will not) changed much over the last (and following) years we can also conclude about the impact of water and sanitation programmes in Benin in general.

- *Outcome and Impact Indicators:* The main indicators reflecting primary outcome of water interventions are the quantity and quality of water available and used in the household and the time spent on water collection (corvée d´eau). We further analyse secondary indicators, measuring the impact of WSS interventions on selected health outcomes (e.g. diarrhoea) and livelihood outcomes (e.g. health costs, the number of days having been ill and not being able to work or to go to school).

- *Period:* Although WSS programmes have been and will be in operation for many years (e.g. the PPEA runs from 2007 to 2012) for methodological reasons (see before) as well as for practical reasons the interventions considered only cover the period 2008 to 2010.

- *Surveys:* The study will apply surveys of a sample of localities in rural Benin. An important characteristic of the study is the fact that it employs data from baseline and follow-up surveys in order to analyse changes over time in both localities where WSS programmes are implemented and in localities without such programmes, which offers better possibilities to identify impact compared to studies that rely on a single (cross-section) survey. The baseline survey is planned for 2009; the follow-up survey is planned for 2010.

- *Location:* The *départements* where the impact study will be organized are Mono in the south, Collines in the centre and Borgou in the north-east. Depending on data availability, Couffo will be added. The choice of *départements* to be included is based on the following criteria: a) covering areas that are supported by different donors (in particular the area covered by the German cooperation in the south of Benin); b) trustworthy infrastructure planning and realisation data; and c) geographical and ecological variation.

Note: To analyse the impact of sanitation and hygiene interventions, which are also part of the water and sanitation interventions, as well as to analyse their combined impact with water interventions it would be perfect for a difference-in-difference analysis to also stratify the sample into sanitation treatment and control groups by sanitation intervention. During a fact finding mission it became, however, clear that the sanitation programme planning data are not adequate. Therefore it is not possible to stratify (ex ante) by sanitation interventions. We can therefore 'only' ask and control for sanitation interventions and hygiene education in the questionnaire.

Data sources

- Administrative data on realised and planned water and sanitation interventions for the sample design of the baseline and follow up survey of the difference-in-difference-estimation. The data on realised water interventions is also geo-referenced which allows us to connect it to the DHS data which contains information on health and water usage.

- Data from the 2002 Census.

- Baseline survey in 2009:
  - *Household and village questionnaire:* Survey data on health and water and sanitation access obtained using a structured questionnaire at the level of both the household and the locality. Several socio-economic control variables will also be included. Part of the questionnaire is to be filled in by the enumerator after observing, e.g. the state of the latrines, hand-washing behaviour.
  - *Health centres:* A distinct part of the data collection effort concerns obtaining data from the local health centres (the so called registres). Here enumerators should check entries from the previous two months and record any visits from the localities in the sample with the diagnosis.
  - *Water tests:* Quantitative water tests will be conducted, analysing drinking water at source and at point of use (the household) for E. coli.

- Follow-up urveys in 2010: same as in 2009.

- DHS data from 2006 including geographic reference data which together with the geo-referenced data on realised water interventions allows us to pursue an ex post (cross-sectional) national representative impact evaluation.

Add-on: The survey will be conducted in the dry season (January–March). A smaller survey, with fewer households and a shorter questionnaire, will be repeated in the rainy season (September–October). During several discussions with experts in Benin, the issue of dry versus rainy season came up. One may expect that water use and possibly sanitation behaviour as well as intervention impacts differ depending on the season. For instance, households may use an installed pump during the dry season whereas they prefer to collect and drink (unsafe) rainwater during the wet season.

Qualitative methods

While the emphasis is on a quantitative impact analysis, the study will also comprise a descriptive part which focuses on the institutional framework. This part of the study will be based on existing documents as well as semi-structured interviews with key informants. The description will start from a macro (Cotonou) perspective but will also include interviews at lower administrative levels as well as village interviews. At the village (locality) level, focus group discussions will aim to provide a deeper understanding of the local habits; the type of communication and practice with regard to the adoption of the infrastructure; the organization of the water user committee and issues related to repairs,

maintenance and conflicts; determinants of health; factors that may co-determine the WSS intervention impact.

This qualitative study is largely a background study for the quantitative impact study as it aims to describe the existing institutional organization of the water and sanitation sector and changes therein, covering the evaluation questions 'input', 'project description' and 'output'. This background is important for the reader (donor, politician) as it is necessary to understand the position of donor assistance in the whole of the Beninese water sector as well as the link of (budget) assistance to other programme interventions. In addition, there are a number of closer links between the qualitative and quantitative study. In-depth interviews very often provide knowledge which is valuable both for the design of questionnaires as well as in the interpretation of the survey responses and statistical results. The level of detail in this type of interview cannot be replicated in the structured household or village questionnaires and may elicit information which can shed light on the 'why' question, i.e. on the black box, why we see certain impacts or not.

Sample Design

In order to collect data for the impact analysis as well as for descriptive purposes (see previous section), a sample will have to be chosen. Since including all *départements* is not feasible, the sample selection involves choosing *départements*first, then localities and then households within localities.

Départements

The *départements* chosen for the sample are Mono (in the south), Collines (centre) and Borgou (north-east). As indicated previously, the choice of departments is based on:

1 Covering areas that are supported by different donors.
2 Availability of good quality data concerning realised and planned water infrastructure.
3 A certain amount of geographical and ecological dispersion.

Localities

WSS interventions are planned and executed at the level of the locality. One may often observe villages (clusters of localities) where some localities have received a pump but others have not. Localities are often dispersed (in the north more than in the south) and form distinct entities. For this reason, the study selects a sample of localities within *départements*. In order to compare outcome changes in treatment (T) and control (C) localities, the sample needs to include both types.

Treatment localities: T localities are identified as those on the list of planned works for 2009 of the *départemental* water service (S-Eau). Note that the baseline survey is planned for the beginning of 2009 and the follow-up survey is scheduled for the beginning of 2010.

Control localities: C localities are those where no water infrastructure 'treatment' is planned for 2009. This means, in theory, that C localities can fall into one of three categories: (1)

locality has already received treatment before 2009; (2) locality is scheduled to receive treatment in 2010 or later; (3) locality has not received and is not planned to receive treatment at all.

The timing of the intervention is significant for the proposed pipeline approach. The timing of programme intervention in the various localities is unlikely to be random. In fact, since these are 'demand-driven' interventions the first localities to be allocated an intervention are, on average, those that first applied. This presents the study with a potentially significant confounding factor: it could be that localities which apply first have characteristics (other than the intervention) which cause the outcomes to be better than in localities applying later. These 'characteristics' could be that they have a well-informed and active village (locality) leadership or a good quality social capital. If such characteristics are unobserved by the study, but are in fact important determinants of both the timing of participation and the outcomes, then it is possible that the study attributes impact to the WSS programme where in fact the outcomes might also (largely) be attained in the absence of the programme. The sample should be designed in such a way as to minimize the effects of unobserved confounding factors.

The simplest way to do this is based on timing of the interventions: the date on which control villages or localities will receive or have received WSS treatment should be as close as possible to the date of receipt for treatment villages (pipeline approach). Since treatment localities receive treatment in 2009, we select control villages among those that are planned to receive a water-intervention in the post-study period, 'pipeline' localities (Category 2) and those that have received treatment in 2008 (Category 1). Category (3) is not considered to be a good control group since such localities are not likely to be adequately comparable to T localities (having not applied for a water intervention). Therefore, Category (3) control localities are not sampled.

Add-on: Having pre-study intervention control localities in the sample (Category 1) has two advantages. First, we can also analyse the impact of water interventions in the medium-term (comparing villages that received treatment before 2009 with households that do not receive treatment before 2010; note that we can only do a sole pipeline approach here, without difference-in-difference analysis). Second, since it may be expected that some of these villages have received water infrastructure but not yet sanitation (promotion) this may generate more variation in treatment status of sanitation.

As well as unobservable factors, there are likely to be observable confounding factors which affect the probability of receiving treatment in the period under study as well as outcomes. The study will collect as much information as possible on confounding factors and control for these in the analysis (controlling for 'selection on observables'). A further advantage of controlling for observables is that the standard error of the variable of interest (treatment) is reduced, leading to more statistically significant results.

Sample size: The number of localities has been **provisionally** set at 40 T and 60 C (30 villages having received treatment in 2008 and 30 villages not receiving treatment before 2010) per *département*, so 120 T and 180 C for the whole study. The exact number of *départements* and the number of localities per *département* will have to be determined after careful consideration of a number of issues:

- The quality of the administrative planning data obtained during the fact-finding mission;
- The statistical precision required (what is the minimum detectable effect size that can be measured with a certain probability);
- Other sampling considerations. For example, one may find that stratification gives reason not to choose the same number of localities in each *départements*; and
- Budgetary considerations.

Households

Households will be sampled randomly within localities using a list of households to be obtained by the enumerators upon arrival in each locality. At present, it is not envisaged to stratify within localities. The number of households per locality to be sampled is at least ten.

Precautionary note

A number of uncertainties with respect to study outcomes prevail.

- *Uncertainty about sanitation interventions:* One item is uncertainty with respect to sanitation and hygiene promotion implementation since (good quality) planning data for these activities were not available at the time of the sample design. It is thus not known a priori how many localities will receive sanitation 'treatment' in the period studied.

- *Short observation period:* Another item is the period under study: as explained above, the survey data will cover a period of about two years (January 2009 to September 2010). It may be expected that a number of programme effects can be picked up by the study (e.g. water consumption, short-term health effects) but it may well be that a number of effects or characteristics take more time to become visible. An example is quality and sustainability of the new infrastructure. To capture long-term effects the sample will therefore also include households which received a water treatment in 2008 (see previous section). However, a better option would be to have the second wave at the beginning of 2011. This is not an option because this study is part of a larger IOB study, which has to be finished by the beginning of 2011. Upon completion of the data analysis at the end of 2010, a decision will hence be taken to have a possible third wave if necessary (to allow for a long-term effect analysis).

- *Complementary development support:* Another concern is that localities that receive a water intervention in 2009 receive some complementary development support during the same time period, and the study hence overestimates the impact of water interventions on health. During a fact-finding mission it became clear that the timing of water interventions for villages is very much dependent on the support those localities receive

from NGOs, which might also foster other programmes. The questionnaire will hence include several questions on NGOs' role in the mobilization and implementation of the water and sanitation programme and the study (as already indicated) will aim for similar control group villages.

- *Caveat with respect to the 'impact of institutions':* It is important to emphasize that the statistical identification of the effects is at the level of the villages (localities) and households; it makes use of locality-level variation in 'activities' (interventions) and, mainly, household-level variation in 'outcome' and 'impact' measures. This means that items in the column 'inputs' (see policy framework, Table 4) usually do not lend themselves to statistical analysis since they are hard to measure at the locality level and/or do not vary over localities and time.

Activities and timetable

July-August 2008
- Finalize research plan and budget (sub-contractors)
- Approval of research plan
- Desk review of relevant documents
- Create locality level database with realised and planned interventions

September-October 2008
- Sample design
- Develop questionnaire for baseline and follow-up survey
- Develop training and field manuals
- Develop data entry screens in consultation with local research team and customize data entry software.
- Sub-contract local research team; start selection and contracting of field workers (interviewers, supervisors and data entry team)

December 2008
- Training of supervisors and field workers (6)
- Pilot survey and data entry test
- Analyse the results of the pilot study to determine changes needed

January-March 2009
- Data collection 2009 – dry season
- Data entry and cleaning 2009 – dry season

September-October 2009
- Data collection 2009 – rainy season
- Data entry and cleaning 2009 – rainy season
- Presentation and discussion of study progress with partners in Cotonou

November-December 2009
- Data analysis – analysis of first-round survey and DHS data
- Ex post retrospective impact study
- Interim report on results baseline study

January-March 2010
- Data collection 2010 – dry season
- Data entry and cleaning 2010 – dry season

May 2010
- Data analysis – impact identification (dry-season data)

September-October 2010
- Data collection 2010 – rainy season
- Data entry and cleaning 2010 – rainy season
- Presentation and discussion of study progress with partners in Cotonou

November 2010
- Data analysis – impact identification (all data)

December 2010-March 2011
- Drafting of final report
- Presentation of (draft) final report in a relevant stakeholders seminar
- Workshop on impact evaluation (in cooperation with Benin research team)
- Revise draft final report based on the workshop conclusions and in consultation with IOB and BMZ–KfW

Organization

The impact evaluation will be a joint effort of the Policy and Operations Evaluation Department of the Netherlands' Ministry of Foreign Affairs (IOB) and the Division for Evaluation of Development Cooperation and Auditing, German Ministry for Economic Cooperation and Development (BMZ) in association with the evaluation department of KfW Development Bank. Overall, supervision for the preparation, implementation and reporting is with Henri Jorritsma, deputy director and inspector IOB and Michaela Zintl, head of evaluation and audit division, BMZ, together with Herbert Voigt of the evaluation department of KfW (German contact). They will also comment and advise on the main draft documents of the impact evaluation, notably draft interim reports and draft final reports. The final responsibility for the Terms of Reference and the evaluation report is with IOB and BMZ in association with KfW.

The Amsterdam Institute for International Development (AIID) is the main contractor for this impact study. The AIID has already been selected by the IOB by competitive bidding for a framework contract on impact evaluations in developing countries. The current study falls within this framework contract. The AIID will subcontract the researchers listed below:

(1) ***Dr Youdi Schipper***, economist/consultant and assistant professor at the Vrije Universiteit Amsterdam and AIID. Dr Schipper is one of the principal investigators in the impact study and is responsible for the overall execution of the project; he will account for a significant share of the tasks and will co-author the final report.
(2) ***Dr Isabel Guenther***, economist/consultant and assistant professor at the NADEL institute at the Swiss Federal Institute of Technology (ETH) in Zürich. Dr Guenther is one of the principal investigators in the impact study and will account for a significant share of the tasks outlined in Section 6; she will co-author the final report.

(3) ***Thea Hilhorst*** (senior advisor, Royal Tropical Institute) will implement the qualitative and institutional side of the study and write the corresponding sections of the report.
(4) ***The Benin research team***, headed by the Institut Regional pour la Santé Public (IRSP) – the team includes researchers from various research institutions in Benin, representing the different fields of knowledge and experience necessary for the study. The researchers are:

a Dr. Guy Nouatin, socio-anthropologue (FSA : Faculté d'Agronomie, Université de Parakou)
b Sylvain Kpenavoun Chogou, Agro-economiste (Faculté des Sciences Agronomiques, Université d'Abomey-Calavi)
c Moussiliou Noël Paraïso, épidémiologiste (IRSP. Institut Régional de Santé Publique)
d Alexandre Biaou, Ingénieur Statisticien-économiste (INSAE : Institut National de la Statistique et de l'Analyse Economique)
e Dr. Esaie Gandonou, Agro-economiste (Faculté des Sciences Agronomiques, Université d'Abomey-Calavi)

(5) ***The water-test team***, which mainly consists of the staff of the Laboratoire Impetus in Parakou and which is funded, trained and supervised by the University of Cologne (http://www.impetus.uni-koeln.de). In August 2009, the Laboratoire de Direction General d'Eau will take over the Labaratoire Impetus in Parakou. Hence it is difficult to say in what form the Labaratoire Impetus will continue to exist thereafter, but AIID will try to negotiate a contract over the whole research period 2008-2010.

(6) ***A junior consultant*** (Ph.D Student, already identified) to assist in survey implementation, data cleaning and liaison during and after the survey implementation.

Deliverables

The following deliverables are foreseen.

December 2009
Interim reports are foreseen as building blocks for the final report:
A report on the institutional (qualitative) analysis and the operationalization of water and sanitation interventions; and
A report on the baseline study with details on the definitive sample. This report will also contain baseline descriptive statistics and correlations as well as a retrospective impact analysis of WSS interventions in rural Benin.

March 2010
Meeting with the IOB, the KfW and the BMZ to discuss interim reports.

December 2010
Database with a two-wave-panel comprising data on water and sanitation interventions, health and socio-economic characteristics of households and localities.

January 2011
Draft final reports (see June 2011).

March 2011
Meeting with the IOB, the KfW and the BMZ to discuss (draft) final reports.

June 2011
(a) Final report on the impact of water and sanitation interventions on water quantity and quality, health and livelihoods in Benin.
(b) A methodology paper comparing different methods for impact evaluation (to be delivered mid of 2011).

All reports will be discussed with the IOB, the KfW and the BMZ. The timetable includes discussion meetings on the progress of the study with authorities in Benin as well as with the Netherlands Embassy and the German Development Cooperation representatives, Cotonou. All reports will be written in English; IOB will take care of translation of the reports into French. The IOB and the BMZ–KfW will decide later whether the final reports will be shared with other donors.

Annex 2 Sustainability assessment – list of interviews

List of Interviews sustainability assessment Benin 2009			
Date	**Activity**	**No of people present**	**Location of interview**
Monday 12/10			
8.00	Briefing: embassy of the Netherlands and KfW	Staff (4 people)	Embassy of the Netherlands -Cotonou
8.30	Meeting with some other donors active in the water and sanitation sector (GIZ, World Bank, Danida)	Staff (8 people)	Embassy of the Netherlands-Cot
10.30	Meeting DGeau	15 people	DG Eau HQ-Cot
12.00	Meeting with AT of GIZ aand Danida working for DG Eau	3 people	DG Eau HQ-Cot
15.00	DHAB	C/DHAB and 2 technical staff	DHAB office-Cot
16.30	Discussion with author of focus groups discussion report	Guy Nouatin	Hotel - Cot
Tuesday 13/10			
9.00	Meeting with SNV, MDGLAAT/ DAT Meeting with FADeC was not possible	7 persons	MDGLAAT/DAT office -Cot
12h00	Travel Benin-Grand Popo		
14.00	Visit to AEV under construction with DED and a Management committee forrage	3 Committee members, 1 person selling water, 2 citizens buying water, DED, S-Eau	Sazué –water points
16.00	Meeting with local authorities in a village with AEV, near to Soneb connections; meeting	S-Eau, chef d'arrondissments, chef de village, 4 citizens, DED	Djanglanmey – office of c/ d'arrondissement
17.00	Health centre Djanglanmey	Interview with medecin chef	Health centre
Wednesday 14/10			
9.00	Meeting with authorities Grand popo local government	Mayor, 4 councillors, SEau, DED	Offices commune of Grand Popo
12.00	Health centre Lokossa	Interview with medecin chef	Health centre
15.00	NGO working as intermediation social- Mono	NGO staff (directors and 6 staff), DED, S-Eau	Grand popo
17.00	Visit water points possotomé	No interviews-observations staff SEau and DED	

Thursday 15/10			
9.00	Meeting with S/eau staff	Director and 5 other staff	Offices S-eau Lokossa
11.00	Meeting with GIZ and DED staff working in Mono	1 GIZ, 2 DED	Offices of TA in Lokossa, S-Eau Mono
12.00	Meeting with services HAB at the regional level	Regional chef, assistant hygiene	Ministry of Health
14.00	Meeting local government staff working on water and sanitation in Lokossa -commune	Exchange with 4 staff	Offices commune of Lokossa
	Visit to pump near lokossa	Interviews with 5 members management committee and extension worker	In the community
Friday 16/10			
10.00	Meeting with mayor of the Dogbo commune	Mayor, in presence of GIZ staff	Office commune Dogbo
13.00	AEV Bopa –privatised management	Interview with exploitant and 3 ex-members management committee	AEV Bopa
16.00	NGO working as intermediation social- Coffou	NGO director	Office NGO
Saturday 17/10			
9.00	Loc gov staff responsible for water in Lalo	1 person	Office commune Lalo
10.00	Meeting with 2 reperateur -artisan		Office commune Lalo
11.00	Visit to village with three different pumps near Lalo	Interview with 5 women gathering water (in group setting), total 8 management committee members (3 different pumps), c/d'arrondissment; chef de village	In the community
12.00	Travel to Parakou		

Monday 19/10			
9.00	Meetings with staff S/eau in Parakou	10 people	Offices S/Eau
11.00	Discussion TA Danida	1 person	Office S/eau
14.00	Meeting SNV staff	5 stafs	SNV office Parakou
15.30	Meeting HAB at regional level	1 person; exchange with Cotonou staff also present	Ministry of health, Parakou
16.30	Meetings trésor public	5 people (different departments)	Ministry of Finance Parakou
19.00	Dinner with DG eau staff responsible for training	2 staff	
Tuesday 20/10			
9.00	Meeting mayor bembéréké	1 person	Office Local government in Bembéréké
10.00	Meeting staff	2 person	Office Local government in Bembéréké
11.00	Meetings with management committee members of all water points in the local government area	40 people	Office Local government in Bembéréké
14.00	Visit AEV –privatised,	Exploitant, 2 members ex- committee; users	Community level
15.00	Visit pump	4 Management committee members	Community level
16.00	Meeting chef d'arrondissement Ina		Office c/d'arrondissement
Wednesday 21/10			
10.00	Meeting local government staff Tchaouré	Mayor, responsible water programmes	Office Local government in Tcharoué
14.00	AEV privatized with problems	Chef d'arrondissement; ex- 6 management committee members, 10 villagers	Office c/d'arrondissement
	Meeting with management company representative (hydro-plus)	1 person	Near water point
16.00	Social watch members Tchaoure	8 people	At a school

Thursday 22/10			
10.00	Meeting "comité eau' Savé	C/SEau; mayor, chefs d'arrondissement (in total 15 people)	Offices local government of Savé
	Meeting c/d'arrondissement Logozohe, Savalou	1 person	Office c/ arrondissement
	Meeting with "relais villageois hygiene" working in the local government area	10 persons	Offices local government of Savalou
Friday 23/10			
9.00	Meetings with staff S/eau	8 staff	Offices C/Seau in Dassa
11.00	Meeting with staff HAB- collines TA danida- Padsea	4 people	Office HAB
14.00	Local government staff Glazoué	4 people	Offices local government of Glazoue
16.00	Meeting with artisan/ reparateurs association	About 30 people	Meeting room in Glazoue
17.00	Unplanned Visit to Water pumps to be privatised	2 Committee members living nearby	site
Saturday 24/10			
9.30	Staff of local government in banté		Banté
11.00	AEV with privatized management	1 Representative company, 1 seller of water, chef d'arrondissement, 3 members of ex-Management committee	Banté
13.00	Return Cotonou		
Monday 26/10			
08h00	Embassy of the Netherlands	2 persons	Embassy
09h15	SNV	1 person	SNV
10h30	TA Danida	1 person	DG Eau
11h30	TA GIZ:	1	Dg Eau
12h15	TA AFD	1	DG eau
15h00	CREPA Benin	3	Crepa office
16h00	PNE.	2	PNE Office
17h00	MEF -DGB	1	Min. of finance

Tuesday 27/10			
10h00-12h00	MDGLAAT -DGAE et DGDGL	2	Ministry MDGLAAT
14.00	Foraq (Entreprise de Forage)	1	Company office
16.00	european Union	1	EU office
Wednesday 28/10			
09h00	Debriefing DGEau		DG Eau
15h00	Debriefing Embassy of the Netherlands, KfW, GIZ		Embassy

Annex 3 List of surveyed localities

Departement	Commune	Arrondissement	Village	Localite
Collines	Bante	Agoua	N'tchon	N'tchon
Collines	Bante	Atokolibe	Agbon	Adjigo
Collines	Bante	Gouka	Kamala	Kamala
Collines	Bante	Gouka	Mamatchoke	Mamatchoke
Collines	Bantè	Atokolibè	Malomi	Malomi
Collines	Bantè	Bobe	Bobe	Bobe
Collines	Glazoue	Ouedeme	Yagbo Kpassassa	Yagbo Kpassassa
Collines	Glazoue	Thio	Agouagon	Agouagon
Collines	Glazoue	Thio	Bethel2	Bethel2
Collines	Glazoue	Thio	Thio	Kpassali
Collines	Glazoue	Aklamkpa	Sowiandji	Ahoussindoho
Collines	Glazoue	Sonkpota	Akouegba	Akouegba
Collines	Glazoué	Aklamkpa	Sowiandji	Gastondoho
Collines	Glazoué	Zaffé	Adourekouman	Okouta
Collines	Savalou	Doume	Affe Zongo	Affe Zongo
Collines	Savalou	Kpataba	Koutago	Koutago
Collines	Savalou	Lahotan	Lahotan	Dame
Collines	Savalou	Lema	Kadjogbe	Kadjogbe
Collines	Savalou	Lema	Lema	Lema
Collines	Savalou	Logozohoue	Loukintowin	Loukintowin
Collines	Savalou	Monkpa	Aga	Aga
Collines	Save	Kaboua	Okounfo	Gah Laiman
Collines	Save	Offe	Gobe	Gobe
Collines	Savalou	Doume	Doume_lakoun	Doume_lakoun
Collines	Savè	Kaboua	Okounfo	Okounfo
Collines	Bante	Agoua	N'tchotche	N'tchotche
Collines	Bante	Akpassi	Banon	Agbeloba
Collines	Bante	Bobe	Djagballo	Djagballo
Collines	Bantè	Atokolibe	Aloba	Aloba
Collines	Bantè	Atokolibe	Aloba	Kafele
Collines	Bantè	Atokolibe	Aloba	Temidire
Collines	Bantè	Lougba	Gotcha	Aletan 2
Collines	Bantè	Pira	Adjigo	Holi
Collines	Glazoue	Gome	Gome Ifada	Gome Ifada

Collines	Glazoue	Sokponta	Oke Okounou	Oke Okounou
Collines	Glazoue	Sokponta	Sokponta	Sokponta
Collines	Glazoue	Thio	Camp Peulh	Camp Peulh
Collines	Glazoue	Thio	Thio	Assromihoue
Collines	Glazoue	Thio	Thio	Balakpa
Collines	Glazoue	Zaffe	Madengbe	Madengbe
Collines	Glazoué	Assante	Assante	Setogoudo
Collines	Glazoué	Zaffe	Adourekouman	Adourekouman
Collines	Savalou	Lahotan	Agbomandin	Agbomandin
Collines	Savalou	Lahotan	Awiankanme	Awiankanme
Collines	Savalou	Lema	Zongo	Zongo
Collines	Savalou	Monkpa	Walla	Walla
Collines	Savalou	Ouesse	Lowozoungo	Lowozoungo
Collines	Savalou	Tchetti	Koffodoua	Koffodoua
Collines	Savalou	Tchetti	Kpadji	Kpadji
Collines	Savalou	Tchetti	Odo Agbon	Odo Agbon
Collines	Save	Sakin	Diho	Diho 2
Collines	Save	Kaboua	Gogoro	Meyadougou
Collines	Save	Kaboua	Okounfo	Gah Ilassa
Collines	Save	Ofe	Atchakpa	Achakpa 1
Collines	Save	Sakin	Diho	Diho 1
Collines	Bante	Gouka	Galata	Galata
Collines	Bante	Gouka	Mayamon	Mayamon
Collines	Bante	Gouka	Sako	Sako
Collines	Bante	Gouka	Zongo Centr	Zongo Centr
Collines	Bante	Pira	Adjigo	Adja-Pira
Collines	Bante	Pira	Adjigo	Adjigo
Collines	Bante	Pira	Idi Ogou	Idi Ogou
Collines	Bante	Lougba	Gotcha	Domi Abra
Collines	Bantè	Agoua	Cloubou	Cloubou
Collines	Bantè	Atokolibe	Atokolibe	Atokolibe
Collines	Bantè	Pira	Idi_ogou	Afanti
Collines	Collines	Kpataba	Lozin	Lozin
Collines	Glazoue	Aklankpa	Aklankpa	Allawenon 1
Collines	Glazoue	Thio	Thio	Dekoundji
Collines	Glazoue	Zaffe	Abidoun	Abidoun
Collines	Glazoue	Aklankpa	Alawenonssa 2	Alawenonssa 2

Collines	Glazoué	Assanté	Gbanlinhanssoé	Hounnondoho
Collines	Glazoué	Assanté	Houin	Coffihoué
Collines	Glazoué	Gome	Ayede	Ayede
Collines	Glazoué	Ouèdemè	Kpota	Finangnon
Collines	Glazoué	Sokponta	Tchakaloke	Tchakaloke
Collines	Savalou	Lohotan	Awiankanme	Segbeya
Collines	Savalou	Lohotan	Kpakpavissa	Kpakpavissa
Collines	Savalou	Ouesse	Agbodranfo	Agbodranfo
Collines	Savalou	Tchetti	Ottele	Ottele
Collines	Save	Kaboua	Kaboua	Oke Oloui
Collines	Save	Offe	Tchanmina	Tchanmina
Collines	Savalou	Monkpa	Dodomè	Dodomè
Collines	Savè	Ofe	Atchakpa	Atchakpa 2
Collines	Bante	Akpassi	Ilare	Tchambala
Collines	Bante	Gouka	Gouka-Centre	Gouka-Centre
Collines	Bantè	Atokolibe	Agbon	Agbon
Collines	Glazoue	Aklankpa	Affizoungo	Angola Gbaffo
Collines	Glazoue	Gome	Tankossi	Tankossi
Collines	Glazoué	Aklankpa	Allawenonsa Ii	Coffidoho
Collines	Glazoué	Aklankpa	Allawenonsa Ii	Linsidoho
Collines	Glazoué	Aklankpa	Sowiandji	Sowiandji
Collines	Glazoué	Assante	Houin	Sebiodaho
Collines	Glazoué	Gome	Gome	Gome
Collines	Savalou	Gobada	Lama	Lama
Collines	Savalou	Kpataba	Codji	Codji
Collines	Savalou	Kpataba	Mondji	Mondji
Collines	Savalou	Lahotan	Zomakidji	Zomakidji
Collines	Save	Okpara	Kpanoudo	Kpanoudo
Collines	Save	Sakin	Diho 1	Iwe 1
Mono	Aplahoue	Aplahoue	Aflantan	Hounsahoue
Mono	Athieme	Atchannou	Koudohounhoue	Hounviadihoue
Mono	Athieme	Athieme	Agbobada	Zingbedji
Mono	Athieme	Athieme	Awame	Kponou
Mono	Bopa	Yegodoe	Fandhoui	Tanwenou
Mono	Bopa	Agbodji	Ganhonou	Medetogbo
Mono	Dogbo	Lokogohoue	Lokogohoue	Monthonhoue
Mono	Dogbo	Lokogohoue	Midangbe	Midangbe

Mono	Dogbo	Madjre	Madjre	Makouwehoue
Mono	Dogbo	Totchangni	Totchangni	Akahoue
Mono	Dogbo	Totchangni	Totchangni	Honkonhoue
Mono	Dogbo	Totchangni	Totchanhgni	Kpokpohoue
Mono	Grand Popo	Djanglanmey	Tolebekpa	Adjahlin Condji
Mono	Grand Popo	Djanglanmey	Tolebekpa	Tolebekpa
Mono	Grand Popo	Djanglanmey	Vodomey	Guiakpa Condji
Mono	Grand Popo	Sazue	Djanglanmey	Hankandji
Mono	Grand Popo	Sazue	Gnito	Gnito
Mono	Grand Popo	Sazue	Sazue	Saloukou
Mono	Grand Popo	Djanglanmey	Sazue	Kpatcha Condji
Mono	Houeyogbe	Dahe	Aguehon	Awlinhoue
Mono	Houeyogbe	Doutou	Gbagbonou	Honkouhoue
Mono	Houeyogbe	Doutou	Tokpa	Metanandjo
Mono	Houeyogbe	Houeyogbe	Kedji	Dincome
Mono	Houeyogbe	Se	Houetihoue	Houetihoue
Mono	Lalo	Hlassame	Kpassakanmey	Kpassakanmey
Mono	Lokossa	Koudo	Tozounme	Tchatchahoue
Mono	Lokossa	Koudo	Tozounmey	Lokogbassa
Mono	Toviklin	Avedjin	Avedjin	Sognonnouhoue
Mono	Toviklin	Doko	Toulehoudji	Nagandahoue
Mono	Toviklin	Tannou Gola	Houssoumey	Edouhoue
Mono	Athieme	Atchannou	Adhame	Adhame
Mono	Bopa	Agbodji	Agbodji 2	Anadji
Mono	Bopa	Agbodji	Logloe	Tchankahoue
Mono	Bopa	Agbodji	Agbodji 2	Agboh
Mono	Bopa	Agbodji	Logloe	Todjadji
Mono	Bopa	Agbodji	Zizague	Zizague
Mono	Bopa	Agboji	Logloe	Logloe Centre
Mono	Bopa	Badazouin	Medessedji	Honwi
Mono	Bopa	Yegodoe	Fandihoui	Gbeto
Mono	Bopa	Yegodoe	Fandihouin	Fandihouin
Mono	Dogbo	Lokogohoue	Hounsa	Kokohoue
Mono	Dogbo	Totchangni	Gnigbe	Gnigbe
Mono	Dogbo	Totchangni	Lada	Lada Centre
Mono	Dogbo	Totchangni	Totchangni	Honkonnou 1
Mono	Dogbo	Totchangni	Totchangni	Totchangni Centre

Mono	Grand Popo	Sazue	Sazue	Sazue Centre
Mono	Grand Popo	Sazue	Sazue	Sokouhoue
Mono	Grand-Popo	Sazue	Sazue	Akpohoue
Mono	Grand-Popo	Sazue	Sazue	Tokpota
Mono	Houeyogbe	Doutou	Adjame	Aglihoue
Mono	Houeyogbe	Doutou	Agongo	Kpassouigo
Mono	Houeyogbe	Se	Danklo	Fanouhoue
Mono	Lalo	Hlassame	Adjaglime	Adjaglime
Mono	Lalo	Hlassamey	Oukanmey	Oukanmey
Mono	Lalo	Hlassamey	Wewehoue	Wewehoue
Mono	Lokossa	Koudo	Tozounme	Dansouhoue
Mono	Lokossa	Koudo	Tozounme	Gbedjame
Mono	Lokossa	Koudo	Tozounme	Missebo
Mono	Lokossa	Koudo	Tozounme	Sedje
Mono	Toviklin	Avedjin	Avedjin	Avedjin Centre
Mono	Toviklin	Avedjin	Dandjekpohoue	Dandjekpohoue
Mono	Toviklin	Doko	Djidowanou	Koumakpohoue
Mono	Toviklin	Tannou Gola	Tannou Gola	Sodjinouhoue
Mono	Toviklin	Tannou Gola	Tossehoue	Tossehoue
Mono	Toviklin	Tannou Gola	Tossehoue	Tossouhoue
Mono	Aplahoue	Aplahoue	Aflantan	Kpanhoue
Mono	Bopa	Lobogo	Devedji	Hanouhoue
Mono	Come	Come	Soukpotome	Agbedjrhoue
Mono	Djakotomey	Kpoba	Fantchoutchehoue	Centre
Mono	Djakotomey	Kpoba	Nakidahohoue	Nakidahohoue
Mono	Djakotomey	Kpoba	Zohoudji	Edahoue
Mono	Djakotomey	Kpoba	Zohoudji	Mavihoue
Mono	Dogbo	Lokogohoue	Bessanhoue	Bessanhoue
Mono	Dogbo	Lokogohoue	Houndromey	Gbematchihoue
Mono	Dogbo	Lokogohoue	Lokogohoue	Demagnonhoue
Mono	Dogbo	Lokogohoue	Lokogohoue	Koukouihoue
Mono	Dogbo	Lokogohoue	Lokogohoue	Sonougbehoue
Mono	Dogbo	Lokogohoue	Segba	Segba
Mono	Dogbo	Madjre	Adandro-Akode	Adandro-Akode
Mono	Dogbo	Madjre	Madjre	Affohoue
Mono	Dogbo	Madjre	Madjre	Sogadjihoue
Mono	Lokossa	Koudo	Tozounme	Assoutohoue

Mono	Toviklin	Tannou Gola	Dohodji	Dohodji2
Mono	Toviklin	Tannou Gola	Tannou Gola	Agbohoue
Mono	Toviklin	Tannou Gola	Tannou Gola	Tannou Gola
Mono	Aplahoue	Aplahoue	Aflantan	Kassegnihoue
Mono	Aplahoue	Aplahoue	Aflantan	Nawahoue
Mono	Aplahoue	Aplahoue	Bozinkpe	Koyohoue
Mono	Come	Come	Honve Come	Guincodji
Mono	Djakotomey	Kpoba	Fantchoutchehoue	Assouhoue
Mono	Djakotomey	Kpoba	Fantchoutchehoue	Hounsahoue
Mono	Djakotomey	Kpoba	Fanthoutchehoue	Dahouehoue
Mono	Dogbo	Lokogohoue	Hedjame	Hedjame
Mono	Dogbo	Lokogohoue	Houndromey	Bassanhoue
Mono	Dogbo	Lokogohoue	Hounsa	Djehouhoue
Mono	Dogbo	Lokogohoue	Hounsa	Hounsa
Mono	Dogbo	Lokogohoue	Toulehoudji	Datchiglohoue
Mono	Dogbo	Lokogohoue	Vehedji	Vehedji
Mono	Dogbo	Madjre	Madjre	Noumonvihoue
Mono	Toviklin	Tannou-Gola	Dohodji	Dohodji 1

Annex 4 References

Ambs, P., 2010. *Evaluation du processus de professionnalisation de la gestion des AEV – Bénin*. Freiburg, Germany and Cotonou, Benin, Fichtner Water & Transportation GmbH, DG Eau, Water and Sanitation Programme

Barthel, R., B. G. J. S. Sonneveld, J. Götzinger, M.A. Keyzer, S. Pande, A. Printz and T. Gaiser, 2009. Integrated assessment of groundwater resources in the Ouémé basin, Benin, West Africa. *Physics and Chemistry of the Earth, Parts A, B and C 34 (4-5), pp. 236-250*

Belbéoc'h, A., C.C. Eteka, J. Gbaguidi and R. Boco, 2008. *Analyse des obstacles au processus de professionnalisation de la gestion des adductions d'eau villageoises dans le département des Collines*. Programme d'appui de l'Agence Française de Développement au budget-programme de l'hydraulique rurale. Cotonou, Benin, DG Eau, AFD, ANTEA

Blankwaardt, B., M. Diallo, C. Adjinacou and J. Gandjidon, 2006. *Aide sectorielle neerlandaise au programme d'approvisionnement en eau potable en milieu rurale (2004-2006)*. Cotonou: Direction Générale de l'Hydraulique- Ministère de l'Energie et de l'Eau

Cairncross, S. and V. Valdmanis, 2006. *Water supply, sanitation and hygiene promotion*. In: Jamison, D.T., J.G. Breman, A.R. Measham et al. (eds), Disease control priorities in Developing Countries (2nd ed.). Washington, D.C.: The World Bank

Carlos, J. and S. Akofa Asare-Kokou, 2004. *Les femmes prennent la parole*. Cotonou: SNV

CPLB–Benin, 2009. *Livre bleu Benin: l'eau, l'assainissement, la vie et le développement humain durable*. Cotonou, Secrétariat permanent du Comité de Pilotage du Livre Bleu Benin (CPLB-Benin), GWP–PNE Benin, PDM, Protos and le secrétariat international de l'eau

DANIDA, 2004. *Document de programme d'appui Phase 2 (2005-2009), Programme d'Appui au Développement du Secteur Eau et Assainissement (PADSEA) Bénin*. Cotonou: Benin, Ministry of Foreign Affairs, Government of Benin and Copenhagen, DANIDA

DG Eau, 2007. *Rapport d'exécution du budget programme 2006 de l'hydraulique rurale et semi-urbaine* (Provisional report). Cotonou, Benin, Ministère de l'Energie et de l'Eau

DG Eau, 2009. *Rapport d'exécution du budget programme 2008 de l'hydraulique rurale et semi-urbaine*. Cotonou, Benin, Ministère de l'Energie et de l'Eau

DG Eau, 2010a. *Rapport d'exécution du budget programme 2009 de l'hydraulique rurale et semi-urbaine -version provisoire*. Cotonou, Benin, Ministère de l'Energie et de l'Eau

DG Eau, 2010b. *Programme Initiative Eau dans les centres semi-urbains du Bénin II- pour la période 2011-2013*, document de discussion. Direction Générale de l'Eau Ministère des Mines de l'Energie, et de l'Eau ; Water and Sanitation Program – Cotonou, World Bank

DH (Direction de l'Hydraulique), 1992. *Stratégie de développement du secteur de l'alimentation en eau et de l'assainissement en zone rurale*. Cotonou, Benin, DH and la Société Béninoise de l'Electricité et d'Eau (SONEB) –Ministère de l'Energie, Mines et Hydraulique

DH, 2006. *Rapport d'exécution du budget programme 2005*. Cotonou, Benin, Direction Générale de l'Hydraulique – Ministère de l'Energie et de l'Eau

Duflo, E., Glennester R. and M. Kremer, 2006. *Using Randomization in Development Economics Research: A Toolkit*.

FAO, 2005. *Aquastat Country Profile: Benin*. Rome, FAO

Esrey, S. A. ,1996. Water, Waste and Well-Being: A Multicountry Study. *American Journal of Epidemiology 143(6)*

Esrey, S. A., J. B. Potash, L. Roberts and C. Shift, 1991. Effects of improved water supply and sanitation on ascariasis, diarrhoea, dracunculiasis, hookworm infection, schistosomiasis, and trachoma. *Bulletin of the World Health Organization 59(5)*

Fewtrell, L. and J. M. Colford, 2004. *Water, Sanitation and Hygiene – Interventions and Diarrhoea: A Systematic Review and Meta-analysis*. Washington D.C.: World Bank

Fewtrell, L., R. B. Kaufmann, D. Kay, W. Enanoria, L. Haller and J.M. Colford, Jr., 2005. Water, sanitation, and hygiene interventions to reduce diarrhoea in less developed countries: a systematic review and meta-analysis. *Lancet Infectious Diseases 5 (1), pp. 42-52*

HAADI (Les programmes Hydraulique et Assainissement en Appui au Développement Intégré), 2008. *Capital d'un apprentissage pionnier pour la Maîtrise d'ouvrage Communale dans le Secteur de l'eau potable et de l'assainissement au Bénin*. Document de capitalisation. Cotonou, Benin, HAADI, PROTOS and SNV

Hadonou, A. M. and S. Lambrecht, 2009. *Analyse du contexte de l'eau et de l'assainissement dans les quatre départements du nord Bénin*. Cotonou, Benin, Protos and ICCO

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

Hilhorst, T. and C. Adjinacou, 2008. *Can the Sector-wide Approach Strengthen Local Development Institutions? The Case of the Water Sector in Rural Benin*. Amsterdam, Royal Tropical Institute (KIT)

INSAE (Institut National de la Statistique et de l'Analyse Economique), 2008. *Projections départementales 2002-2030*. Cotonou, INSAE and Ministère chargé de la prospectivité, du développement et de l'évolution de l'action publique (MPDEAP)

INSAE, 2009. *Enquête modulaire intégrée sur les conditions de vie des ménages (EMICoV) – 2007: principaux indicateurs*. Cotonou, Ministère chargé de la prospectivité, du développement et de l'évolution de l'action publique (MPDEAP)

Kpatchavi, C., 2009. *État des lieux de la reddition des comptes dans les communes de Dogbo, Ouinhi et Sinendé et élaboration d'indicateurs de suivi – évaluation*. Cotonou: Embassy of the Kingdom of the Netherlands and SNV

Kremer, M. and A. P. Zwane (2007). What works in fighting diarrheal diseases in developing countries? A critical review. *The World Bank Research Observer 22(1)*

Lambrecht, S., 2006. *Programme d'appui au développement du secteur Eau potable et assainissement en milieu rural dans les départements de l'Atacora et de la Donga (PADEAR- A/D) –une expérience capitalisée*. Cotonou, Benin, Belgian Technical Cooperation and PADEAR

Langley, P., 2007. *Capitalisation de l'évolution générale du CREPA: bilan critique et analyse stratégique*. Ouagadougou, Burkina Faso, CREPA

Nouatin, G. and I. Moumouni, 2009. *Rapport des focus group discussions dans les départements des Collines, du Borgou et du Mono-Couffo*. Cotonou, Benin, Institut Régional de Santé Publique and Amsterdam Institute for International Development (AIID)

Prüss-Üstün, A., R. Bos, F. Gore and J. Bartram, 2008. *Safer Water, Better Health: Costs, Benefits and Sustainability of Interventions to Protect and Promote Health*. Geneva: WHO

République du Bénin, 2006. *Medium Term Expenditure Framework 2006*

République du Bénin, 2007. *Stratégie de croissance pour la réduction de la pauvreté 2007-2009*. Cotonou, Benin, Government of Benin

Silliman, S. E., M. Boukari, P. Crane, F. Azonsi and C.R. Neal, 2007. Observations on elemental concentrations of groundwater in central Benin. *Journal of Hydrology 335 (3-4), pp. 374-388*

Sijbesma, C., J. Verhagen, R. Nanavaty en A.J. James, 2009. Impacts of domestic water supply on gender and income: results from a participatory study in a drought-prone region in Gujarat, India, in *Water Policy 11, pp. 95-105*

UNDP (United Nations Development Programme), 2006. *Development Report*. New York: UNDP

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

White, H., 2006. *Impact Evaluation: The Experience of the Independent Evaluation Group of the World Bank*. Washington D.C.: World Bank

WHO, 2008. *Guidelines for Drinking-water Quality*. Third Edition. Volume 1, Geneva: WHO

WHO-UNICEF, 2006. *Meeting the MDG drinking water and sanitation target. The urban and rural challenge of the decade*. Geneva: WHO

WHO-UNICEF, 2008. *Progress on drinking water and sanitation*. UNICEF-WHO

WHO-UNICEF, 2010. *Progress on sanitation and drinking water*. Update. UNICEF-WHO

World Bank, 2003. *World Development Report 2004: Making Services work for poor people*. Washington D.C.: World Bank

World Bank, 2004. *Benin Public Expenditure Review. Enhancing the Effectiveness of Public Spending: A Review of Three Sectors*. Report No. 29656-BEN. Washington, DC: World Bank

World Bank-IEG, 2008. *What works in water supply and sanitation? Lessons from impact evaluations*. Washington D.C.: World Bank

Wright, J., S. Gundry and R. Conroy, 2004. A systematic review of the health outcomes related to household water quality in developing countries. *Tropical Medicine and International Health 9 (1), pp. 106-117*

Zohou, R 2006. *Diagnostique du department de l'Atlantique*. S-Eau Atlantique

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), pp. 1-24*

Published by:

Ministry of Foreign Affairs
Policy and Operations Evaluation Department (IOB)
P.O. box 20061 | 2500 EB The Hague | The Netherlands
www.minbuza.nl/iob

Language editing: Contactivity b.v. Leiden
Front cover photo: Testing Water Quality
Photographs: Carel de Groot, Thea Hilhorst, Elena Gross

Germany and the Netherlands have provided support for rural water supply and sanitation programmes in Benin for many years. A joint impact study was undertaken to measure the impact of the programmes that have received this support. Benin is on its way to achieving its targets on improved water sources, but safe drinking water is still not secured – and water facilities are not always being constructed where they are needed most.

Hygiene and sanitation require even more attention, and some subsidization will continue to be necessary to sustain facilities and services.

Published by:

Ministry of Foreign Affairs
Policy and Operations Evaluation Department (IOB)
P.O. box 20061 | 2500 EB The Hague | The Netherlands
www.minbuza.nl/iob

11BUZ283781 | E

This project was the product of a cooperation between:

Ministry of Foreign Affairs of the Netherlands

BMZ Federal Ministry for Economic Cooperation and Development