In search of Sustainability of Rural Water Supply Facilities:

A case study of borehole projects in Burkina Faso

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To Guillermo and Esperanza.

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LIST OF ACRONYMS

APM: Area pump mechanic
CBO: Community based organization
CCS: Community Currency Systems
CLE: Local Water Committees
FRUGAL: Forming rural utility water groups and leases
UNESCO: The United Nations Educational, Scientific and Cultural Organization IRC: International Water and Sanitation Centre
ISW: The International Secretariat for Water
IWRM: Integrated Water Resources Management
LG: Local Government
MCC: Management committee formed by CREDO
MDG: Millennium development goals
NGO: Non governmental organization
O&M: Operation and Maintenance
PP: Private person
PPOM: Public Private Operation and Maintenance
POOM: Private Ownership Operation and Maintenance
Rs: rank correlation coefficient.
SKAT: Swiss Resource Centre and consultancies for development
UN: United Nations
UNDP: United Nations Development Program
VLOM: Village Level Operation and Maintenance

GLOSARY

AMBF: Association des Municipalités du Burkina Faso (Burkina Faso's Municipalities Association)
CREDO: Christian Relief and Development Organisation (Woord en Daad's partner organization in Burkina Faso)
CREPA: Centre Régional pour l'Eau Potable et le Assainissement á faible coût (Regional Centre for Low Cost Water and Sanitation)
DGAEP: Direction Générale de l' Approvssionament en Eau Potable (Directorate General for water supply)
DGIRH: Directeur général de l'inventaire des ressources hydrauliques (Directorate General for the inventory of water resources).
FAUREB: Fédération des associations d'usagers de l'eau de la Région Bobolaise (Federation of Water User's Association of the Bobo Dioulasso Region)
PAGIRE: Le Plan d'Action pour la Gestion Intégrée des Ressources en Eau (Plan for Integrated Water Resources Management)
TOD: Textes d'Orientation de la Décentralisation (Guiding Texts for Decentralization)
UEMOA: Union economique et monetaire oust-africaine (West African Economical and Monetary Union)
W&D: Woord en Daad (Dutch NGO)

Introduction

"There is no 'blueprint' for sustainable rural water supply. Sustainability is a complex issue made up of many factors or 'building blocks'. Water supplies will not be made sustainable by simply piling these blocks on top of one another.

Instead, they must be considered carefully in relation to one another to build sustainable services. A holistic approach to planning and implementation is essential"

(Harvey et al 2004:xix)

Boreholes provide a good alternative to safe water supply in rural areas. They help to solve problems of water scarcity and lack of access to it in significant ways; positively contributing towards reaching the MDG's related to water. However, the issue of their sustainability is hindered by problems of disrepair and abandonment.

Successful sustainability is determined largely by operation and maintenance of boreholes: "Effective O&M is essential for sustainability." (Harvey 2005: i); and it is made out of many aspects regarding ownership, technical, social, organizational, cultural, institutional, etc., issues.

Throughout time, many models for O&M of boreholes have been tried out in search of sustainability. Nowadays, community management constitutes the most used approach, getting strong support from the international water supply sector.

However, sustainability continues to be a problem, currently being tackled mostly through approaches such as "scaling up", which points out at the institutional context in which borehole projects are implemented and managed after implementation: "The most important principle [of scaling up] is the creation of institutional support mechanisms for sustainable community managed services" (IRC 2004:1).

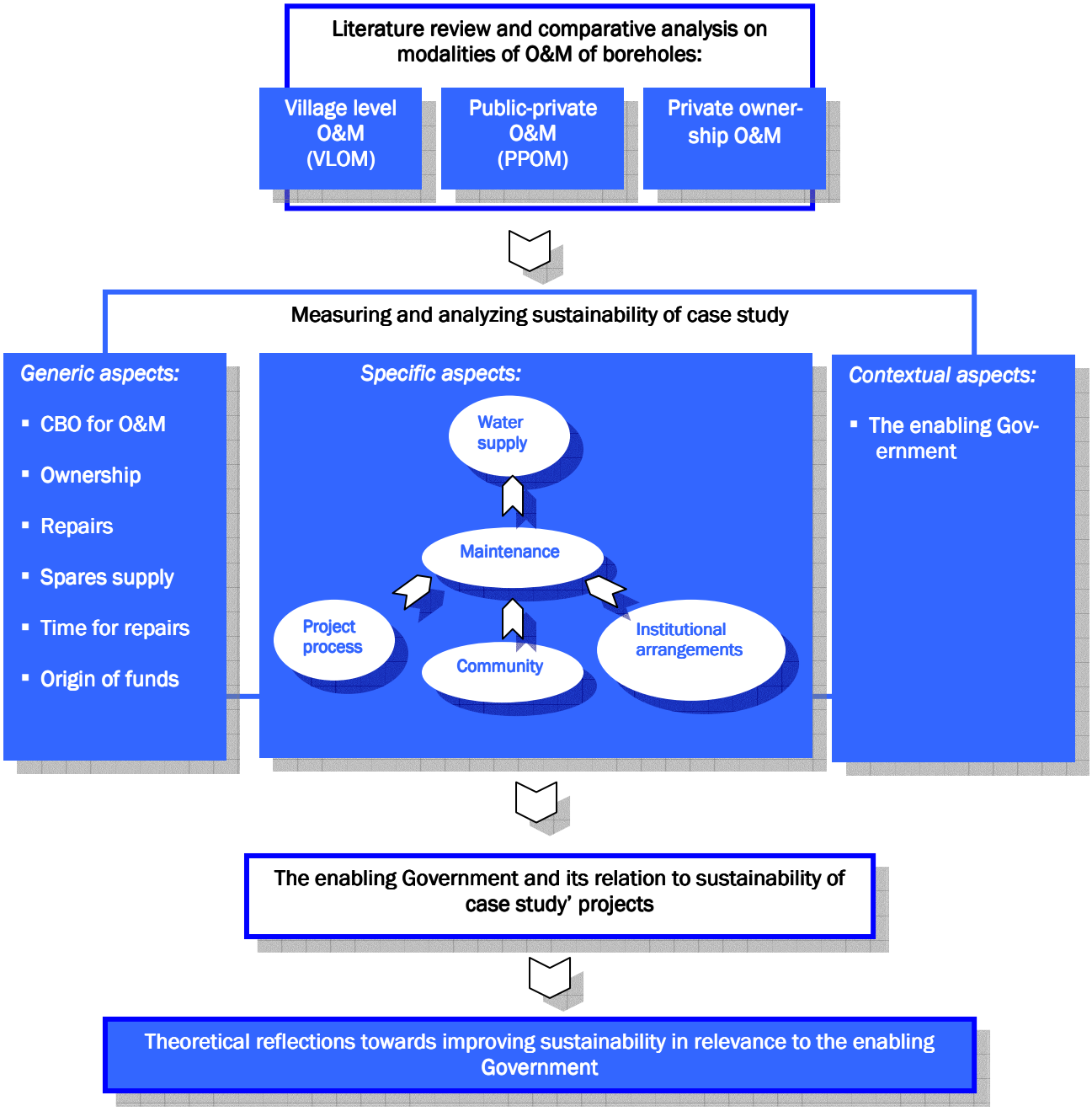
It is then that the concept of the enabling government acquires crucial importance to analyze rural water supply, looking into contextual aspects that would provide institutional support in search of sustainability : "enablement involves important changes in institutional arrangements, with a greater involvement of civic society, through which public policies are initiated, formulated and implemented" (Helmsing 2000:9).

To look into such aspects, I will refer to a case study in one of the countries in which Woord en Daad implements borehole projects: Burkina Faso. Like many other countries in Africa, Burkina Faso shows comparatively low levels of rural water coverage, as well as water points in full operation.

In this report, I will conduct a literature review and analyze different modalities for maintenance of boreholes, identifying success and failure factors for sustainability. I will then measure and analyze sustainability of the case study, which consists in 20 borehole projects. in Burkina Faso, implemented by CREDO, W&D's local partner organization. I will do so by analyzing generic and specific aspects, as well as the contextual aspect of Local Government. Finally, I will draw theoretical reflections for different modalities appropriate to findings of the case study, considering the relevance of the concept of the enabling Government.

The figure in the next page describes the structure of the report

Figure 1: The structure of the report



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Chapter I
Modalities in operation and maintenance of boreholes

1.1 Operation and Maintenance defined

Operation and maintenance are two of the most important issues that determine successful sustainability for water supply systems. Operation refers to "the everyday running and handling of a water supply. This involves several activities: Major operations required to convey safe drinking water to the users...and…the correct handling of facilities by users to ensure long component's life…"(Davis et al 1995: 5).Maintenance refers to "the activities required to sustain the water supply in a proper working condition" (ibid).

O&M comprises all activities conducive to have the borehole working continuously in good shape, for the benefit of the community. This activities comprise elements such as regulating who can use the hand pump, taking care of it, collecting contributions from the community for purposes related to its operation, establishing contact with the LG to find support, repairing it, calling or contracting someone who can repair it; etc.

It's important to note that O&M is more than just repairing the borehole when it breaks down; it's also about preventive maintenance, which consists in carrying out all activities mentioned before as a routine, to prevent the borehole from breaking and falling into disrepair and disuse. Therefore, it is appropriate O&M that determines successful sustainability.

There are three types of O&M (Adapted from Harvey et al (2004)):

- *Preventive*: systematic activities aimed at early detection of defects to avoid breakdowns or deterioration.
- *Corrective:* activities conducted as a result of a breakdown, carried out only after a defect has been detected.
- *Rehabilitation:* activities to correct major defects leading to restoration of a facility, including replacing the hand pump if it is completely broke.

1.2 Sustainability defined in relation to water supply

Many definitions for sustainability have been elaborated in search of analysis of aspects that influence it within the context of water supply projects, and yet, there's not a common or universal definition for sustainability: "…differing responses… point to the…complexity of the challenges that all practitioners face when trying to plan, design and implement sustainable projects" (Parry-Jones et al 2001:6). However, for the purpose of this report, I will refer to a definition elaborated by Harvey et al (2004):

"A water service is sustainable if the water sources are not over-exploited but naturally replenished, facilities are maintained in a condition which ensures a reliable and adequate water supply, the benefits of the supply continue to be realized by all users indefinitely, and the service delivery process demonstrates a cost-effective use of resources that can be replicated."

Furthermore, sustainability is influenced by generic, specific and contextual aspects, as will be further elaborated in chapter II.

1.3 O&M main modalities

O&M modalities for boreholes have greatly varied throughout time. They've ranged from centralized management systems by the Government, going through three tier

systems (community, local-area mechanics and LG) and community based approaches. Experiences with the last have been fruitful and brought on benefits as community organizational capacities strengthening, a focus on bottom up approaches to development, etc.

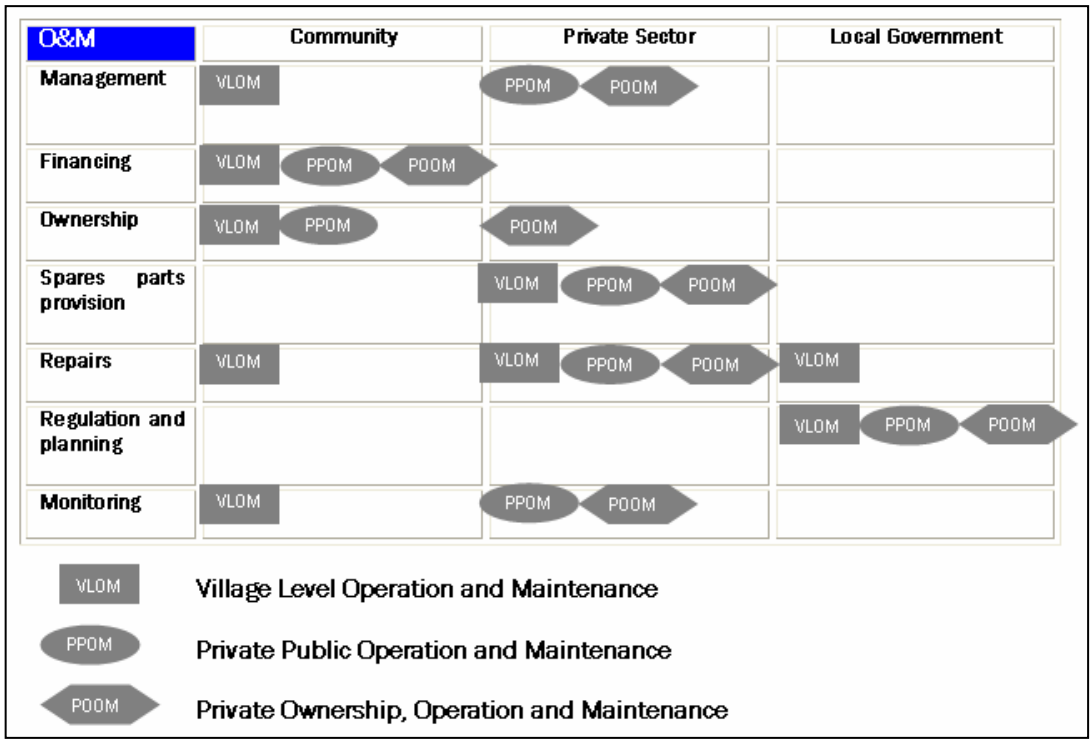
But still, sustainability within this modality is context dependent, and it might not be the best approach for all cases. Issues of funds and supply chain of spare parts are of crucial relevance to all modalities in search of sustainability.

I hereby provide a short description of main modalities of O&M, as defined by Harvey et al (2004):

- **Village Level Operation and Maintenance (VLOM)** refers to maintenance systems which are owned and managed by the user community, who finances and facilitates O&M. The private sector/LG or NGO provides spare parts and technical services. The public sector/NGO regulates.
- **Public-Private Operation and Maintenance (PPOM)** refers to situations where a private sector organization is responsible for managing and delivering maintenance and repair services, regulated by the Government. The Community owns the facility and finances maintenance costs. The public sector regulates.
- **Private Ownership, Operation and Maintenance (POOM)** refers to situations where the water supply facility is owned and maintained by a private organization or individual. The Community pays the latter to collect water from the system, and the public sector regulates.

Main actors within this classification operate as shown in figure 2 in respect to the main activities that O&M involves:

Figure 2: Main actors' roles in respect to O&M' main activities



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Besides interventions from the main actors, involvement from other actors such as NGO's, Ministries, international or national cooperation agencies and donors are all transversal to each of these modalities, and might be found in every one of them.

There are a number of sub modalities within each of the three main modalities, which are explained and analysed in the next section. References for further reading and an example where possible on each of the sub modalities are provided in Annex I.

1.4 Village Level O&M (VLOM) sub modalities

1.4.1 Community volunteers

This is the traditionally most widely used system in VLOM approaches. Community members are responsible for most of the activities related to O&M, where some of them act as pump technicians, having been trained in preventive and corrective O&M, and also provided with tools, sometimes shared by more than one community. Repairs are free of cost done by Community members on voluntary basis. (Harvey et all 2004: 170) This task might be performed by a tap or neighbourhood committee (Brikké 2000:171).

- **Disadvantages:** Trained community members also have income earning activities, they might leave the village for better opportunities and find no time to conduct appropriate O&M. Spare parts are not easily fetched by Community members because they imply costs of transportation and major breakdowns are not easily repaired because of lack of technical expertise.
- **Advantages:** Community volunteers are free of cost, they always live in the same village, making it easier to save time and conduct other activities at household level.
- **Success factors:** Strong support from NGO's, International cooperation agencies or LG to overcome difficulties of access to spare parts and lack of expertise for major breakdowns. Motivation for trained community members to dedicate enough time for O&M.

1.4.2 Area pump mechanics

This approach implies payment from the community members to an outsider for rehabilitation and maintenance. The outsider is a trained private repairman responsible for several communities, who fixes the water pump on call of the community members, who in turn are in charge only of preventive O&M on voluntary basis. This repairmen, or area pump mechanic might be trained by the LG or an NGO, and might also be involved in other income earning activities, for experience in Uganda and Kenya have shown that there's not enough demand to make it an exclusive occupation. However, they can eventually compete with neighboring area pump mechanics for work. Some institutions might fix repair rates for their services. (Harvey et all 2004: 171).The Community might be organized through a water committee responsible for general management and control, but contracts a private body (an individual, a mechanic, a group of artisans, or a firm) to operate and maintain the system. (Brikké 2000:171).

- **Disadvantages:** If there's not enough demand, APM's will find more profitable ways to make a living. Access to spare parts might still represent a negative issue. If repairing services increase in price, community members might not be willing to pay. Weak regulation might result in wrong prices for repairs.
- **Advantages:** Curative maintenance is assured. The modality allows for regulation from the LG on tariffs.

There's also better quality of work since the APM's eventually gain more experience.

- **Success factors:** Ability and motivation of communities to collect funds and pay for external O&M, generation of enough demand in the area, efficient regulation, access to spare parts, availability of dual roles for APM's (e.g.: working in the community health centre when there's no demand for repairs), competition among repairmen in order to improve standards and lower costs to communities, clustering of communities. Adequate density of hand pumps.

1.4.3 Circuit riders

This modality is similar to the "area pump mechanics", but it implies higher involvement of the LG and having the community pay for both preventive and corrective maintenance, which is carried on by an outsider. A number of hand pumps mechanics are trained by LG, provided with a bicycle and assigned about 35 hand pumps to take a preventive maintenance visit to each every four months, in which the community pays a fixed rate per visit. If a spare is soon to be needed, the hand pumps mechanic notifies the Community and it's their responsibility to buy the spare before the next preventive maintenance visit in which the hand pump mechanic will install it at no extra cost. He might also be called for an emergency, and has other means of income. The LG might partially subsidize costs of O&M (Harvey et all 2004:172).

- **Disadvantages:** It might be difficult to have the Community understand the importance of preventive maintenance, and even more to have them pay for something that has not yet broken. Community might not have easy access to get the spares.
- **Advantages:** Preventive and curative maintenance are assured. There are more incentives for repairmen to do their jobs properly and in time since they have assured demand. Breakdowns can be fixed more rapidly.
- **Success factors:** A stronger support from LG in providing bicycles and subsidies is vital, as well as training for the mechanics. Also conscience rising among community members on the importance of preventive maintenance, as well as adequate density of hand pumps.

1.4.4 Water user groups

A water user group is an entity composed of 25-50 household members of a community that have voluntarily joined together in search for sustainable O&M of a water point, and have also been provided with legal status by the LG and full ownership of the water point. Access to the Water user group is open to local NGO's and related institutions, also to already existing CBO's within the Community. The water user group has right of occupancy over the borehole; and affairs should be run on principles commonly agreed upon in a Memorandum of Understanding. (Harvey et all 2004:77).The main difference in this approach is the legal status of the water user group, and the higher number of members. They might decide to conduct both preventive and corrective O&M themselves and seek training support from NGO's or LG or to contract out.

- **Disadvantages:** Coordination among members of the Water user group might be more difficult to achieve, hierarchical structures and administrative procedures might generate costs towards organization. Communication and consensus is more complicated over matters concerning O&M. Legal status might be hard to achieve if there's no supportive LG and favouring policies towards

CBO's, and it's also more prone to political clientelism.

- **Advantages:** Legal status of Water user group increases sense of responsibility for O&M, rights and responsibilities are backed up by a legal framework that penalizes offenders/ intruders. Water user groups also enjoy legal protection at district and village levels, and have full control over use of assets, including O&M.(Harvey et all 2004:77)
- **Success factors:** High organizational and coordination capacity at village level. Political and legal support from and within LG's to provide legal status to WGO. Willingness and capacity of LG's or NGO's to strengthen organizational capacities of Water user groups.

1.4.5 Community partnerships

This approach is highly centralized, ownership of the water facilities remains with the LG, who leases out the O&M to a village user's association formed and legally registered by the LG for that purpose. The users association charges tariffs to users to recover their O&M costs. The users association can subcontract technical personnel for additional O&M. (WSP-WB 99: 1-4). Local authority has delegated O&M responsibility to the water Committee or user's association, whereas decision-making to all other aspects is held by the local authority. (Brikké 2000:171).

- **Disadvantages:** The point of departure is the LG being owner, administrator and regulator of the water point users, a typically centralized provision of water services, which is everyday becoming scarcer through decentralization policies currently in practice. Little sense of ownership and few rights over the water point from its users.
- **Advantages:** Capacity of user's association to sub contract specialized technicians for major repairs. Their legal status increases sense of responsibility for O&M, and grants rights and responsibilities backed up by a legal framework.
- **Success factors:** Issuing clear guidelines by LG for tariffs setting, to generate accountability and willingness to pay from the users. Standards for service and water quality. Entrepreneurial nature from the village members. Transparency of the user's association.

1.4.6 Agency and Community Partnership

A non governmental agency forms a partnership with a community, the agency being responsible for national planning and resource mobilization, as well as short and long term support and monitoring; whereas the Community is responsible for short and long term management and maintenance, as well as financial responsibility for system upkeep and extension. The partnership implies sharing of knowledge, joint decisions, well defined commitments, supporting CBO's, and appropriate training, among others. (Davis et al 1995:53)

- **Disadvantages:** Poor integration with LG, forsake of sectorial plans for water provision and O&M of water points. Strong support from an agency is required. It might be useful to start up investment on the water point use, but might also provide only a temporary solution to sustainability.
- **Advantages:** Might make up for unsustainable subsidized O&M from LG towards the Community. It also implies a top down approach to planning for O&M and selection of technology, leading to tailor-made models for O&M.

- **Success factors:** Presence of an active agency, willing to conduct a top down approach to O&M, sharing decision making and planning participatory methodologies, which implies more expenses in training and developing organizational capabilities within the Community.

1.5 Public-Private O&M (PPOM) sub modalities

1.5.1 Bidding for least subsidy approach

The Least Subsidy approach involves a private company or consortium bidding for the minimum or least subsidy to install and maintain water systems to agreed service levels for a fixed period (e.g. 15 years). These private companies need to assess how much revenue they will recover from community contributions in order to determine what level of subsidy they will require from the Government over this time period. This should be achieved through consultation with the communities involved and willingness-to-pay surveys. The Government then pays the minimum subsidy to the company and the communities pay their water tariffs. This approach is also known as "output based aid" (Harvey et all 2004: 175).

- **Disadvantages:** It can't be used in dispersed communities where presence of the private sector is weak. It demands capacity from LG's to conduct public bids and availability of funds for subsidies, which might not be present in rural LG's.
- **Advantages:** Overcomes lack of skills from Community members to conduct major repairs and provides timely solutions to major breakdowns, at the best price available.
- **Success factors:** Favouring policies for subsidy from LG are imperative, as well as enough private companies to generate competition and effectiveness. It also requires public sector regulation. (Harvey et all 2004: 175)

1.5.2 Total warranty scheme

This modality is about a partnership among a foreign pump manufacturer, a local after-sales private enterprise (s), LG and users. The manufacturer is responsible for support and training towards local enterprises and provision of spare parts, and provides a warranty on a piece of equipment. Users pay an annual contract fee to local enterprises which are responsible for O&M and major breakdowns, regulated by LG. (Harvey et all 2004: 175).The monitoring function remains with the Community.

- **Disadvantages:** Annual fees and few breakdowns might undermine willingness of the Community to fulfil payments, under the premise that "if it is not broken, don't fix it".
- **Advantages:** Spares for major breakdowns are rapidly delivered to the hand pump site, especially in remote places where scarcity of reliable spares is high. Knowledge spillovers form the manufacturer towards local enterprises.
- **Success factors:** The incentives for the manufacturer must be sufficient in terms of future sales of pumps, as well as spares, and strong partnerships must be developed with local enterprises (Harvey et all 2004: 175)

1.5.3 Water assurance scheme

This approach is quite similar to the total warranty scheme, but the main difference lies in that instead of the foreign manufacturer providing a warranty over equipment, the focus is centred in local indigenous companies providing annual maintenance, water

monitoring and repairs service (ensuring water quality, maintaining and repairing installations, upgrading in line with demand), regardless of the technology involved. Users pay a monthly premium to the local company, regulated by LG. In this way, an insurance scheme or contract takes place between the water users and the private company. The company is not linked to a particular manufacturer of spares, but has been trained on transferable skills, capacity and expertise. More than one company might be involved, working as a net of spare providers. (Harvey et all 2004: 176).

- **Disadvantages:** Monthly fees and few breakdowns might undermine willingness of the Community to fulfil payments, under the premise that "if it is not broken, don't fix it". Adequate expertise, training and capacity building, as well as a network of local companies might not always be available.
- **Advantages:** Independence from foreign manufacturers reduce time of repairs of major breakdowns. Closeness of local indigenous companies to communities facilitates ongoing monitoring and O&M. Strengthening the local private indigenous sector is a major plus.
- **Success factors:** Available network of local companies, as well as possibility of training, capacity and expertise skills building.

1.5.4 Government maintenance contract

This approach is the most basic highly centralized of all PPOM's. LG manages and finances the systems and contracts out maintenance to the private sector. If a repair is needed, a member of the Community contacts LG to report the breakdown. Most contracts imply replacing the whole pump, rather than a repair, so the efficiency of such approach is highly questionable. In lack of resources for mobilization, LG might wait until several pumps have broken down in a particular area to send repairmen. (Harvey et all 2004: 177).

- **Disadvantages:** Big time lags between the community call for repairs and the actual repair. Bureaucracy form LG, as well as inefficiency and lack of funds interfere with efficiency.
- **Advantages:** Even the poorest members of the Community are entitled to enjoy all benefits of the water source since there's no forced payment for O&M. The legal status of LG facilitates contracting out and standardization of equipment and spare parts.
- **Success factors:** Policies from LG supporting free provision of water. Efficient LG in terms of time response and availability of funds. High density of hand pumps and availability of private sector contractors.

1.5.5 Manufacturer-NGO model

This approach is a variation of the total warranty scheme, and similar to the Community Partnership in VLOM, differing in that coordination falls under the responsibility of an NGO. An NGO subscribes a partnership with a private manufacturer who provides spares and hand pumps, technical advice and training, which might be local or international, working through local agents. (Harvey et all 2004: 43).

- **Disadvantages:** Few knowledge spillovers and limited strengthening of CBO's capacities, since focus of the partnership is among the NGO and the private sector.
- **Advantages:** The implementing agency has a reliable supplier of goods and services, and the manufacturer has a continued demand for its products over the long term. Water users receive ongoing support on O&M and assure

their access to equipment and services. (Harvey et all: 44)

- **Success factors**: Selection of manufacturers by NGO's in base of quality. Continued provision of new water systems by the NGO, in order to sustain interest of the manufacturer in selling more. (Harvey et all: 44)

1.5.6 Primary health care model

Through this model, provision of water supply and curative O&M falls under the auspices of a primary health care centre under the Ministry of health. This centre is responsible for delivering healthcare services clinics and community visits. Alongside health staff, water technicians are responsible for implementation of new water system and maintenance of existing facilities. They also take care of the health centre's equipment such as cars, machines, etc. The technicians are paid by the health care institution while communities pay only for the cost of spares provided by them. (Harvey et all 2004: 44).

- **Disadvantages:** Focus and support goes only into curative O&M, little or no training for preventive O&M for CBO's is involved. Availability of spares might be a problem since the private sector is not involved. Lack of funds and available personnel from the health care centre might also represent a problem causing time delays.
- **Advantages**: Cost effectiveness is higher since it draws on existing human resources and means of mobilization. It's also cheaper for the community members since they only pay for the cost of spare parts. "The fact that water supply is coupled with the provision of healthcare leads to improved efficiency in service delivery and greater awareness of potential links between water and disease". (Harvey et all 2004: 45)
- **Success factors**: Presence of an active, strong, fully equipped nearby regional health centre. Support from the Ministry of health from the Central Government, willingness to support the water sector. Enough personnel in the health care centre to attend community calls on breakdowns.

1.5.7 FRUGAL

FRUGAL stands for "Forming Rural Utility Groups and Leases" (WSP 2005:1), which consists in having services for water supply, as well as O&M, built and managed competitively through bid lots covering large areas. The concept behind this approach is to group communities together in order to reduce transaction costs and improve service delivery. Local entrepreneurship is required. FRUGAL is a long-term, private sector management concept under design by WSP-Africa for rural areas, including small towns and disperse rural settlements. (RSWN 2005: 3). This modality has not yet been put to practice; its implementation phase has been projected for years 2008 and 2009. (WSP 2005:1). It is therefore not convenient to conduct further analysis on disadvantages, advantages and success factors.

1.5.8 Leasing

This modality seeks to integrate management of small water piped systems in urban areas with rural water supply projects. It takes advantage of the increasing attention paid by donors to management of small water piped systems in relation to water fees and quality of services, and geographical proximity or rural areas to urban and peri-urban centers. Urban water management committees can offer rural communities a maintenance contract for existing hand pumps, and a lease contract for new hand pumps. Through this concept, donors might focus on training urban water management committees in O&M of hand pumps. Ownership of the

hand pump remains with the urban water committee in a public-private partnership, whereas the rural communities pay to urban water committees for maintenance. (Beers 2001: 413).

- **Disadvantages:** Separate policies for rural and urban water supply might undermine the integrative character of this approach; political will to achieve integration might not always be present. Reliability of rural communities towards urban management committees might not always be present, affecting ongoing supply of services. Mobility costs of urban committees to remote areas increases costs.
- **Advantages:** Both clients and suppliers of O&M benefit from a sustainable service. Suppliers feel motivated by income generation activities, which in turn also promote sustainability of urban water systems. Quality of spares and repairs is improved by urban committees, since they seek reliability from rural clients to have assured demand for their services.
- **Success factors:** Geographical proximity of Rural water systems to their urban counterparts is a must in order to keep costs down and reduce time response to breakdowns. Easy technology or public domain hand pumps should be the type of pump in the rural water systems. Strong support from NGO's to train urban committees in management of water systems. Strong support from LG to provide the necessary legal framework to enforce the partnership. No free cost or sustainable water points nearby generating inconvenient competition.

1.5.9 Short term O&M contracts

This is a relatively centralized model, and a variation of the Government maintenance contract. A private operator is contracted by the LG for O&M of a water system, as well as for billing and collection of O&M fees from the community members. This operator is paid a "management fee", which is linked to the volume of water sold and the number of bills issued. The operator deposits revenues in a joint bank account of the LG, from where he is paid. Revenues collected in excess of the fee might be used for repairs, expansions and improvements of the water system. Operators are hired through bids and contracts, for which the criteria of selection is the base management fee. Contracts last for three years and might be renewed once. (Triche et al 2006: 9).

- **Disadvantages:** Training and upgrading of operators is not part of the approach, which might undermine effectiveness of their work. Since only local operators are contracted, access to nationally unavailable spare parts might be more complicated. An active, dense supply of private operators is necessary to keep costs down, which might be hard to find in dispersed communities. Temporary employment might disincentive private operators.
- **Advantages:** Generation of work for local operators, even if it's temporary. Local operators understand more the context, and can achieve lower operation costs, and are probably willing to undertake small contracts. Involving the LG implies having a legal framework that facilitates conducting bids and contracting out operators as well as standardization of equipment and spare parts.
- **Success factors:** Generation of enough demand, density of hand pumps. A well developed legal framework from the LG in respect to the water sector. No parallel cost-free schemes for O&M.

1.6 Private O&M (POOM) sub modalities

1.6.1 Individual ownership

This modality departs from the "household centered approach" (Parry-Jones et all 2001: 30), which has been developed more in a theoretical basis for urban and peri-urban areas for sanitation facilities. Through this modality, hand pumps would be provided to individual families through subsidies, who would be solely responsible for maintaining the pump and selling water to the rest of the community to cover their costs. (Parry-Jones et all 2001:30). There's a strong connection between individual ownership and sustainability, for there are high incentives for the owner to repair the pump rapidly, because otherwise he looses money. If the pump is owned by the local shopkeeper, access to spares is easier when he travels for replenishing stock for his store. Users might also pay through agricultural produce rather than cash. This approach might also be used where individuals obtain pumps on hire purchase, and can use revenue to pay off the loan (Harvey et all 2004:179). This approach seems to fit in the "self-supply" modality as described by Richard Carter. It is based in the initiative of constructing a water access point of an individual, who retains ownership of it and utilization is shared by a larger group through payment of user fees, whereas upkeep is responsibility of the initiator of the source. (Carter et al 2005: 19). "Users fully pay for continually upgrading locally appropriate solutions, oftentimes at the household level" (RWSN 05:3).

- **Disadvantages:** Implementing the hand pump might generate conflicts among the community on resource allocation of water points. Since water points are assigned on individual basis, no sense of community cohesion to overcome problems hinders taking advantage of collective action towards improvements. Moreover, household members might find other higher more attractive income earning activities and forsake appropriate O&M. To other members of the community, water is necessarily sold, no other choices available.
- **Advantages:** There are high incentives involved in selling water for the owner of the water pump, which leads to better O&M since it becomes an important mean of earning income. Definition of responsible persons for O&M is simplified, and training requirements are punctual. This approach allows for the existence of local currency systems, where community members can pay for water in kind, rather than cash to the pump owner, through a barter system defined by community members.
- **Success factors:** Strong regulation and monitoring on water prices by the LG, to avoid speculation. Generation of enough demand and willingness to pay for water from members of the Community. High autonomy of lower levels.

1.6.2 Lease

This modality is similar to the "Leasing" modality described under PPOM, with the main difference that ownership of the hand pump remains with a local private water company, whereas ownership of the water source remains with the Community. Maintenance contracts are subscribed among a local private water company and several communities. The company is responsible for the operation, maintenance and repair services for existing hand pumps and lease contracts for new or replacement hand pumps, including borehole regeneration. An annual fee paid by community members is collected by a pump care taker for

each community, who's responsible for preventive maintenance (Harvey et all 2004: 180). The annual fee covers caretaker's salary plus O&M provided by the local company. Through this scheme, the local water company may receive support from LG in the form of training. Users might be organized in water use groups with a care taker. If the Community is not paying, the Local water company may remove the hand pump. (Beers 2006:178).

- **Disadvantages:** Sustainability depends on payment of the fee in cash, no other choices available; which might generate exclusion of the poorest community households unless additional actions to prevent this from happening are implemented. Might not be suitable for disperse communities.
- **Advantages:** Availability of spare parts is assured by the local water company, so time delays in repairs are few. Shared ownership of water facilities facilitates preventive and curative O&M. Legal status of the water company facilitates contract subscription.
- **Success factors:** Adequate capacity and skills of local private companies. Enough density of hand pumps in a region for the water company to have more profits than expenses due to mobility costs.

1.7 Cross cutting issues

Successful O&M in all of the modalities previously described is heavily influenced by two cross cutting issues:

- Funds for O&M
- Access to the spare parts supply chain

Although they aren't modalities of O&M per se, I'll briefly discuss different options for increasing and facilitating access to them.

1.7.1 Funds for O&M

- **Pay as you fetch or sell as you grow:** Water users pay a fee to collect water from the source, defined in a price per liter basis, which is later invested in O&M. In communities where cash is scarce for payments, an NGO might help find nearby buyers for agricultural produce in order to generate cash needed to pay the water fee. (Harvey et all 2004:110)
- **Storage and investment:** In order to ensure year-round rapid repair , its convenient to advance mechanisms for funds storage such as: (ibid)
  - Community bank account;
  - Community co-operative;
  - Advance purchase of spares;
- **Goats, maize or spares:** Area pump mechanics are paid in bags of maize, or community members collect maintenance funds to purchase a "community goat", which is then sold in cash when money is needed for repair. Others might invest their funds in buying spares before hand, ready for future use (Harvey et all 2004:111)
- **The Susu scheme:** This is an indigenous financial model to pool resources to maintain water systems in Ghana. It consists in the collection of regular fixed sums of money from groups of villagers. A loan is then given to one person at a time, until each member of the group is served. Beneficiary groups have joint responsibility to pay back the loan with a flat interest rate at the end of an agreed period, which is put to productive uses, enabling the water systems to run continuously throughout the period. (Agbenorheri et al 2005). This modality is similar to the "ROSCA (Rotating savings and credits associations)", found in the informal financial market in Africa among others. These associations consist in a system where "…a lump sum fund composed of fixed contributions from each member of the association is distributed, at fixed intervals and as a whole, to each member of the association in

turn…Its key concepts are…regular contribution with the pool of funds being rotated…, having variations on the manner in which the distribution is decided upon" (Bala 1991: 209).

- **Pooled resources and revolving funds for capital cost and operation and maintenance**: Communities are required a deposit for O&M of the water system before its implementation by an LG sector Agency (5% of capital costs). Several communities might form a private association to save the deposit, which is then transferred to the sector agency. The fund is put into short term deposit with high return interests, which is used for water related activities. Later on, loans are granted to Community boards with no interest for the first three years. (Maxwell et all 2005:5)
- **Rural bankers:** A contribution of 25% is required for new water supply systems, added to a government grant. A local 'champion' in the neighborhood is hired, with the community providing the labor. Payment is by water tariff depending on usage, the revenue from which is used for O&M. Most self-help groups have also set up micro credit schemes, charging interest at around 12%, for income generation and health related expenses.
- **Micro credit for water and sanitation in West Africa:** A partnership is subscribed between a micro credit association and a support organization (An NGO, resource centre) for financial and technical support in construction of water facilities. The support organization links productive activities to loans granting, to decrease the risk of non reimbursement of the credit. Credits are granted on moral values basis and on the condition that the borrower should be known by the credit association. (Kouassi-Kolman 2004: 281)
- **Micro credit for basic services infrastructure in Honduras:** Through this scheme, community families are granted individual loans that together cover the total cost of a project. First, the total cost of the Project is distributed among community families, second, individual credits are granted to them (once the totality of the cost of the project has been reached), and finally, the project is built and starts operating. Families might apply for a second loan for improving the system and collecting O&M funds once they have paid at least 50% of the first loan, and have shown stable payment behavior. A parastatal Institution is in charge of providing credits plus technical and organizational assistance. The collateral required is fiduciary.
- **Social sector funds:** Currently, donor programs have established mechanisms that seek to provide ownership of a water point to the community, facilitate private sector intervention for O&M and LG for regulation. This approach seeks to grant CBO's with access to a decentralized social sector fund, composed by contributions from the Government, NGO's and International Cooperation Agencies, providing with a type of subsidy towards a social good, so they can by themselves conduct O&M and legally own the system. (Parry-Jones et all 2001:29).
- **Productive water point gardens:** Within a livelihoods approach, water supply might be considered beyond domestic use, extending it to agricultural purposes. Sustainability is therefore increased, since it supports income and revenues generating activities, diversifying livelihood strategies. The strategy of this approach is then combining agricultural development programs

with water supply schemes. (Mathew 2005: 51,147). "Water is provided in quantities sufficient for productive use and income generation, mostly at the household level; users recover high % of investment costs and pay for full O&M and replacement costs" (RWSN 2005:3)

- **Subsidies:** either from the LG, private sector and NGO's towards CBO's, to support them cover O&M expenses are obviously another important source of funds, although sustainability might be questionable.

1.7.2 Access to the spare parts supply chain

- **Traditional approach:** Implementing agencies, i.e. LG or NGOs, maintain stocks of spare parts and provide these to users at nominal cost or free of charge. (Harvey et all 04:188)
- **Private sector intervention**: Through a "business approach", private sector actors become involved in spare parts provision because they have sufficient incentives to maintain their involvement. (Harvey et all 04:188) This approach has more potential for viability if "spares supply is linked to the supply of pumps and related services" (Harvey 2005: 5)
- **A "seed fund" for spares:** LG provides a "seed fund" in form of spare parts to a local private operator, who can use revenues to replenish stock. (Harvey et all 04:194)
- **Linking provision of spares with technical services:** An implementing agency trains a local private company in water service provision, building capacity with a range of skills and equipment, so that they diversify their services and means of income. (Harvey et all 04:194)
- **A national framework for spare parts supply:** Baumann in 2000 suggested a network for spares supply:
  - National supplier keeps sufficient and fully comprehensive stocks of spares centrally.
  - In each region, regional dealer keeps adequate stocks to cover at least 80 per cent of breakdowns. Regional dealer sells parts either directly to communities or to an area mechanic.
  - The area mechanic is the principal outlet for spares to communities and sells these with a small profit margin.
  - Government prepares a list of recommended spare parts retail prices for all standardized pumps. (Harvey et all 04:195)
- **Sponsorship and advertising:** Big companies could sponsor acquisition and sale of spare parts along with other products they sell. Additionally, advertising fees paid by the sponsor can be used to cover expenses of spares. (Harvey et all 2004:205)
- **Clustering hand pumps:** Donor agencies implementing hand pump projects might focus on providing their services in nearby villages, to generate more demand for private services and therefore a sustainable supply chain, but it should also provide hand pumps where most needed as an important criteria of selection.
- **Non profit options:** Where presence of the private sector is weak, supply chains led by the local community church have shown to be effective, although it is necessary for them to have adequate capacity, stability and motivation, to overcome limited coverage.

- **Internationally originated supply chains:** A pump manufacturer might provide a complete supply chain from its manufacturing base, passing through the local distributor at district level and to the area mechanics at village level, if there's enough demand of spares from the type of pump they manufacture and if the supply chain is embedded in an existing network (Oyo 2006:04)
- **Central distribution agency:** International cooperation agencies such as the SKAT foundation have provided central distribution agencies and regional outlets with spare parts, and given the responsibility to trade through a distribution network. This might lead to a level of demand that might secure long term sustainability. (Ibid)
- **Technology choice:** The type of pump chosen heavily influences access to the supply chain. Simple technologies, such as the rope and bucket system used in Nicaragua and transferred to some African countries, have few spare parts, and these parts can often be produced locally (Oyo 2006:7).Standardization of hand pumps and spares creates more demand for private operators, providing sustainability for the supply chain, also providing control of management of spares, quality and possibly price. (ibid 2006: 8) Supporting and creating a market through implementing agencies for a determined type of hand pump and spares, facilitates development of the local supply chain, which might also bring prices down, creating economies of scale. Currently, technology choice for hand pumps towards spare parts might be narrowed down to three types: generic spare parts only, few non-generic spare parts and more durable parts (RWSN 2005). The "generic parts only" refers mainly to the rope and bucket system, which is very simple, but can not be used for very deep wells. The "few non generic parts" has spares that wear out fast but are easy to replace, either by buying or informal fabrication. The "more durable parts" wears out very slowly but spares are very expensive and not available everywhere. Each of them might respond better than the other dependent on the context of availability of spares supply and expectations from the Community towards technology choice.

1.8 Comparing village level O&M, public private O&M and private ownership O&M

All three approaches may overlap among each other through different sub modalities previously described, but it is possible to distinguish major characteristics that determine advantages and disadvantages in respect to one another.

Village level O&M builds and improves organizational capacities of Communities, for it is mainly on CBO's that responsibility for proper O&M rests.

This responsibility represents some disadvantages over public private O&M and private ownership O&M: CBO's might not have proper skills and technical expertise to conduct minor and major repairs. Access to the spare parts supply chain is more difficult since there are less chances of having a network of private companies providing spares that are not available nationally.

Lack of proper skills implies relaying on the LG, an NGO or an agency for training, which might not be sustainable due to lack of funds form the LG or no continuous presence of the NGO or agency after a water supply project is finished; so higher

dependence on LG not only as a regulator is generated, which represents a major disadvantage over public private O&M and private ownership O&M.

Moreover, rural LG's are likely to have less capacity than urban LG's to provide appropriate support on these matters and political clientelism might interfere with equalitarian attention to all communities in need.

On the other hand, a major advantage of Village level O&M over public private O&M and private ownership O&M is that normally costs of O&M will be lower, since most activities are done on voluntary basis by Community members rather than for profit-making purposes, although this implies that necessary income earning activities carried on by volunteers might hinder timely O&M.

Village level O&M relies mostly on the informal sector for contracting out O&M, which is good because it strengthens this sector of the market and builds on the local supply chain of spares by local mechanics, but for this to happen, enough demand created by density and proximity of hand pumps is necessary, which is hard to achieve in rural, isolated areas.

Generating competitiveness among local mechanics is not one of the strongest characteristics for Village level O&M, since distances between isolated hand pumps hinders their agglomeration.

Village level O&M normally implies planning O&M through participatory approaches, or right from grassroots organizations, which might not always happen through public private O&M and private ownership O&M.

One of the major advantages of Village level O&M over public private O&M and private ownership O&M is that Communities are in control, generating a sense of pride, building confidence over ownership and operation of the hand pump, which can lead to improved sustainability.

However, successful O&M through Village level O&M rests on three assumptions that might not always comply to every context, as analyzed by Jeremy Colin (1999): The user community will be able and willing to maintain communal hand pumps, the Government will be able to provide an enabling environment and communal hand pumps will be able to meet most rural water supply needs.

Willingness to invest time in O&M is one of the most important factors for successful Village level O&M, and might not be present for several reasons not related to water supply issues, but to income generation, culture, mobility, etc. In some cases, trained people just stop carrying on O&M: "Persons trained…often loose their interest and skills after a while, or their knowledge disappears when they move away" (Beers 2001:413).

Public private O&M seems to overcome problems of access to the spare parts supply chain, since spares are available in larger regional outlet levels for private operators supply, who have greater mobility than CBO's (Harvey 2005:23), creating flow of demand; although not always will this be the case: "Many attempts have been made to start distribution of spare parts through the private sector, but mainly because of rather low profits in the supply chain, specially with the local sellers, this could not sustain itself" (Beers 2000: 413).

However, public private O&M allows for forming private operators' associations, which might improve performance: "These organizations provide opportunities for networking, conduct training courses for operators, and promote growth and professionalism" (Triche et al 2006:34).

On the other hand, public private O&M might be more expensive since it involves paying for O&M besides volunteering for it, so parallel schemes of strengthening and diversifying CBO's

and community members levels of income are necessary in order for this approach to be sustainable. However, this might imply integrating programs from different government institutions, which could be difficult to achieve.

Cash requirements in public private O&M can also be helped through community currency systems, where community members pay for water in kind rather than in cash in a barter system.

Through public private O&M, it's easier to gain access to the international link for spares supply through partnerships for hand pumps and spares supply, reducing the time lag between breakdowns and repairs.

Both for public private O&M and private ownership O&M, partnerships with the formal private sector can facilitate economies of scale and best price available through competition, which might bring costs down. Dealing with the formal private sector also implies having more access to different technology options, increasing chances to choose context-adapted hand pumps.

Public private O&M also overcomes the problem of CBO's lack of skills and technical expertise that severely affects Village level O&M, but enough demand is also necessary to keep the formal sector of water supply services active.

Public private O&M might generate knowledge spillovers for the Community members, and is less dependent on LG to conduct both preventive and curative O&M, increasing sustainability of O&M on this aspect.

Lack of legal status of CBO's might hinder benefits from contracting out the private sector, but this drawback can be overcome by forming user's associations from several communities grouped together, so organizational and legal status are easier to achieve with support from LG, since the number of requests for legalization of CBO's decreases, facilitating administrative work in LG.

Public private O&M takes advantage on drawing communities together and reducing transaction costs, which is a major advantage over Village level O&M. Moreover, since the formal private sector is involved, and Local Governments might perceive benefits over transactions, LG has more incentives to grant CBO's with legal status; since the possibility of tax revenues is opened for the LG.

Having O&M carried on by the private sector represents both advantages and disadvantages over the Village level O&M approach; it encourages best performance of hand pumps, since access to the spare parts supply chain and specialized mechanics for major repairs is facilitated, while it might also undermine willingness to pay if the hand pump doesn't break regularly, as to justify costs of paying for preventive O&M.

Stronger regulation from LG in the form of clear guidelines regarding tariffs for O&M is more in demand than in Village level O&M, in order to keep users satisfied and encourage willingness to pay, as well as setting standards for service and water quality.

Individual operators on public private O&M must be convinced that revenues surpass expenditures, and for that they depend on volume, which is affected by isolation of projects. Contracting out private operators in public private O&M by CBO's requires "expertise in contract administration to ensure fulfilment of contractual obligations, to avoid being ripped off" (Schouten et al 2003: 98), which is seldom present in CBO's, generating more dependency on training skills provided by LG or an NGO to conduct successful management of O&M. Additionally, targeted action to raise awareness and foster joint venture arrangements with the private sector without taking undue risks has to be set from the LG. (Triche et al 2006:1).

Through individual ownership, private ownership O&M has the advantage over Village level O&M and public private O&M of creating higher incentives for the owner to perform best O&M, since he will loose profit making if he fails to deliver proper O&M.

However, individual ownership also implies no capacity building within the community, less knowledge spillovers and increased transaction costs. It also implies that LG has to take a very active role in regulation and legitimization of the individual provider. If it's ownership from a private company, costs will inevitably increase, and the poorest families might loose access to the water source, left with no choices rather than paying in cash.

But the issue of increased costs through privatization has several ways out, for instance, stratifying the rate consumption might help the poorest people gain access to water resources, by defining water fees according to user's capacity to pay.

Moreover, regulation from the LG, in the way of arranging deals for recovery rates provides a major help to the poorest community members.

For instance, in Honduras, the "infrastructure program" implemented by a local parastatal organization named FUNDEVI, grants families with micro credit to build basic services infrastructure, including electricity projects. Once the project has started operating, the Community subscribes an agreement with the national electricity company, where they are granted a discount of the monthly electricity fee until it has covered approximately 60-70% of the initial investment made by families through the loan granted by FUNDEVI.

On the other hand, private ownership O&M might push the LG aside, forsaking already existing sectorial plans for water supply and sanitation. It might also forsake interventions from NGO's, which are likely to have developed mechanisms and expertise for community water supply and O&M, and that tend to conduct water supply O&M through bottom up approaches, which is less likely to take place through private ownership O&M. Since private ownership O&M is likely to operate with large companies, the informal sector of private local operators is left outside and with no demand for their services, unless they are employed by local companies, which might not be always suitable for the company.

Sustainability of water points depends solely on payment of a water fee, since the Community has not been facilitated access to skills to conduct neither preventive nor curative O&M themselves. However, lack of cash, like in public private O&M, can be overcome by using community currency systems. Private ownership O&M also overcomes unwillingness to conduct proper O&M by community members, relying only in willingness to pay for a good service.

Lack of ownership over the water point and water facilities, might undermine willingness to pay and therefore sustainability, although this fact could also act in favour of sustainability, given that rights over the water point and responsibilities have been more clearly delineated than in Village level O&M and public private O&M.

Appropriate available skills, both for major and minor repairs as well as access to the spare parts supply chain and time of response are likely to be improved in private ownership O&M in relation to Village level O&M and public private O&M approaches.

Private ownership O&M seems to overcome the problem of lack of managerial capacity of CBO's, making them less dependent from continuous support from LG and NGO's.

Implementing private ownership O&M implies the ongoing dilemma over privatization of public basic services: In terms of efficiency, "there's a growing body of evidence that the

private sector is no more efficient than the public sector" (Hall 2006:10).Increasing promotion of privatization worldwide has also implied donors cutting back investments to support CBO's on access to sustainable water supply, which in some cases have been "far greater than investments made by the private sector" (ibid:6). On these basis, the world development movement has argued that "private finance has not, and is unlikely, to play an important role in delivering progress towards the water and sanitation MDG's" (ibid:9).

Given the dilemma of doubtful efficiency of the private sector over public delivery of water supply and the increased costs for users it implies, arguments arise on "how aid for water privatization could be better spent" proposing to "increase individual donor support for public-public partnerships within bilateral funding programmes" (Cann et al 2006:9), rather than promote approaches as private ownership O&M.

Success and failure factors for each modality have been summarized in table 1:

Table 1: Summary of success and failure factors for modalities of O&M of bore-holes

Success factors	Failure factors
Village Level O&M (VLOM)	
Appropriate skills and capacity from CBO's and LG's.	Non-participatory methods during implementation
Strong support from LG's, NGO's & agencies or other mechanisms to overcome lack of skills and access to the spare parts supply chain (willingness to increase cost of implementation of the project).	Unwillingness of CBO to conduct O&M
	Technology choice in discordance to available technical skills
	Lack of support from LG, NGO's
	Property rights unclearly legalized
Public Private O&M (PPOM)	
Enough density of hand pumps.	Scarce, isolated projects, low density of pump mechanics
Parallel schemes to strengthen community's levels of income.	Parallel schemes for free water in surrounding areas
Willingness to pay for both preventive and curative maintenance.	Low feasibility of schemes for boosting community's levels of income
Strong regulation from LG in prices.	Low involvement of LG as regulator of prices
Community's skills in contracting procedures.	
No parallel cost-free schemes.	
LG's favouring policies for pump mechanics, available training.	
For the health care centre model, strong linkages among state dependencies.	
Private ownership, O&M	

LG's strong role as a regulator and provider of legitimacy to private owners.	Low income levels
Willingness and capacity to pay.	Low feasibility of parallel schemes to boost community's levels of income
Credibility of local water companies.	Weak capacity of LG to regulate
Enough density of hand pumps	
Willingness to deal with methods of payment like Community currency systems.	
Support from LG: deals for recovery rates and / or stratifying the rate consumption.	

Source: own construction

Chapter II
Case study in Burkina Faso

2.1 Measuring sustainability of the case study' projects

2.1.1 The case study

The case study consists in 20 borehole projects implemented in rural villages of Burkina Faso in the period of 1997-2005. These projects are operating mostly under VLOM modality as described in chapter I, in the sense that there's a community organization in charge of O&M; and repairs and spares are provided either by the private sector, the local church or a nearby health centre. Projects operate under the sub modalities of area pump mechanics, community volunteers, and primary health care centre, the last within PPOM modality.

2.1.2 Measuring sustainability

Analysis of sustainability requires a look into generic, specific and contextual aspects, which comprise sub aspects that influence sustainability:

- Generic aspects: CBO in charge of O&M, ownership issues, repairs, spares supply, time for repairs and origin of funds for O&M.
- Specific aspects: water supply issues, maintenance, community, project process and institutional arrangements.
- Contextual aspects: The enabling Government.

These aspects can be measured through already existing frameworks, as indicated by relevant literature (Harvey et al 2004:267) (Helmsing, 2001). To do so, a survey based on these frameworks [1] was conducted in the sites of the twenty projects, interviewing community members involved in O&M of the projects and an LG official. It provided the base to assign a total score in a scale of one to three for each project, as a result of averaging sub scores of all aspects. Blocks of variables on specific aspects and its scores were also averaged to establish comparisons between them[2] .

The survey's structure provides a score of three when the project fits an ideal situation, two points when the situation leaves room for improvement and of one when it fits a scenario that relates to poor sustainability.

Overall results of the survey showed an average of 2.37 points. However, variation within the sample is significant, ranking from 2.13 to 2.58 points. Therefore, a comparative analysis and a rank correlation analysis within the sample are interesting in order to find out common characteristics of the most successful cases in comparison to those of lowest score.

To that purpose, the sample was subdivided into three groups according to an homogeneous distribution based on their scores, the highest scores in group "A", followed by medium scores in "B" and the lowest scores in group "C". This system of classification yields the results displayed in table 2.

[1] See annex II for the survey applied
[2] See annex III for an example of the calculation of total project's and specific aspects' averages.

Table 2: Classification of projects in relation to total score

Classification		Overall score	Average group score
C	Sia 04	2.13	2.20
	Nadonon 00	2.18	
	Ton'e 03	2.22	
	Sanga 05	2.22	
	Gao 00	2.25	
	Kabouro 04	2.26	
	To(Kindy) 03	2.27	
B	Bagoun 04	2.33	2.4
	Meteo 97	2.34	
	Knakuyo 05	2.36	
	Bieha 99	2.37	
	Nadion 02	2.38	
	Lan 00	2.43	
A	Lon 98	2.47	2.52
	Ly 02	2.48	
	Sati 05	2.50	
	Kayero-Bo (Gogobié) 05	2.51	
	Benavereou 02	2.52	
	Sapouy 97	2.57	
	Kouri 05	2.58	

Source: own construction

More details on scores are displayed in Annex IV.

2.2 Linking sustainability to generic aspects of O&M

I will state a short observation of the trends or patterns observed in data collected for the generic aspects of O&M.

- **Existence of a Management Committee responsible for O&M:** In group A, 100% of the sample has the committee formed by Credo still functional and responsible for O&M, whereas in groups B and C at least one project has no one or the local church pastor appointed for management of O&M.
- **Ownership of the borehole and the plot where it is built:** Group A has the highest percentage of ownership of the boreholes by all members of the Community, whereas group C shows the lowest percentage for this variable, and also the highest percentage of ownership by a community organization. Additionally, group A has the highest percentage of ownership of the plot by all members of the community or a person. On the other hand, group C has the highest percentage of ownership of the plot by an organization.
- **Repairs:** Figure 3 shows distribution of projects over the three groups and persons in charge of repairs:

Figure 3: Distribution of projects in groups (A, B, C) through persons in charge of repairs

Repairs carried by:	A	B	C
Private operator	●●	●●●	●●●●
Mechanics by CREDO in MCC	●●		●●●
Health centre worker from NGO	●●		
Church pastor (formed as a mechanic)+private operator		●	
Mechanics by CREDO + private operator	●	●	
Heath centre worker + private operator		●	

Source: own construction

Where there's higher concentration of repairs carried out by either exclusively the mechanics trained by CREDO from the Management Committee or the private sector, sustainability levels are lower, because of scarcity of area pump mechanics, affecting the market for repairs. Oppositely, groups A and B show a wider distribution over different possibilities from where to draw resources for repairs. It is interesting also to note that shared responsibility for repairs places some projects in group B.

- **Supply of spare parts:** Figure 4 shows distribution of projects over the three groups and persons in charge of spares supply:

Figure 4: Distribution of projects in groups (A, B, C) through persons in charge of spares supply

Spares provided by:	A	B	C
private operator	●	●●●	●●●●●●
health centre worker from NGO	●●		
church pastor		●	
community		●	
mechanics by CREDO + private operator	●●●●	●	

Source: own construction

Highest concentration of the private sector as the sole spare provider occurs in group C. Highest sustainability is matched with higher concentration of mechanics trained by CREDO plus a private operator, as well as through the health centre worker modality.

- **Time consumed in repairs and spares supply:** Time averages for breakdowns per group are as displayed in table 3.

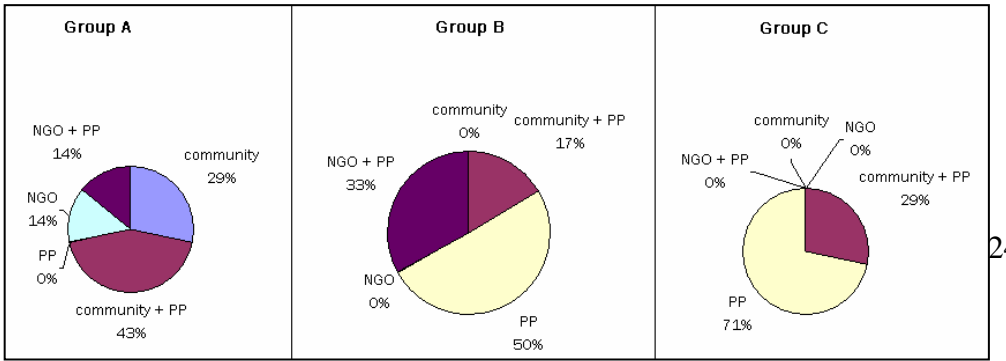
Table 3: Time averages for breakdowns per group

Group	A	B	C
breakdown time average in days	6.00	22.83	233.86

Source: own construction

Logically, shorter times in which boreholes have been out of order occur in groups A and B. Concerning repairs and spare parts supply, actors in charge of such task per group are distributed as shown in figure 5.

Figure 5:



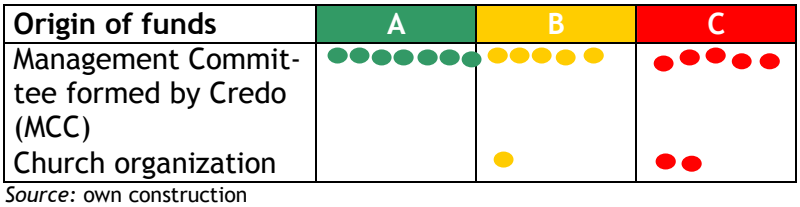
Actors in charge of repairs and spares supply per group

Source: own construction

Where there's higher concentration of repairs carried out by either exclusively the mechanics trained by CREDO from the Management Committee or the private sector, sustainability levels are lower, because of scarcity of area pump mechanics, affecting the market for repairs.

- **Origin of funds for O&M:** Figure 6 shows distribution of projects over the three groups and origin of funds:

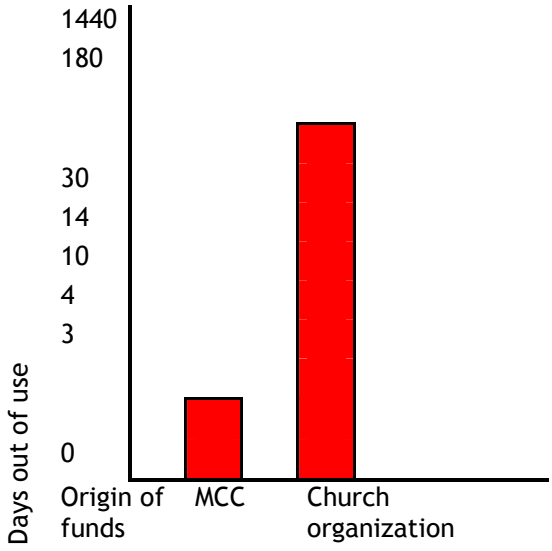
Figure 6: Distribution of projects through three groups (A, B, C) in relation to origin of funds



Source: own construction

Highest levels of sustainability are matched with highest concentration of projects in which the Management Committee formed by Credo (MCC) is the provider of founds. Projects in which the church organization is responsible for funds occur in groups B and C. Figure 7 shows time medians in which boreholes have been out of use compared to origin of funds:

Figure 7: Time of breakdowns in relation to origin of funds



There's a stark contrast among the groups in relation to the days in which the borehole has been out of use: where funds come from the MCC, time needed for repair is much lower than when funds come from the church.

Source: own construction

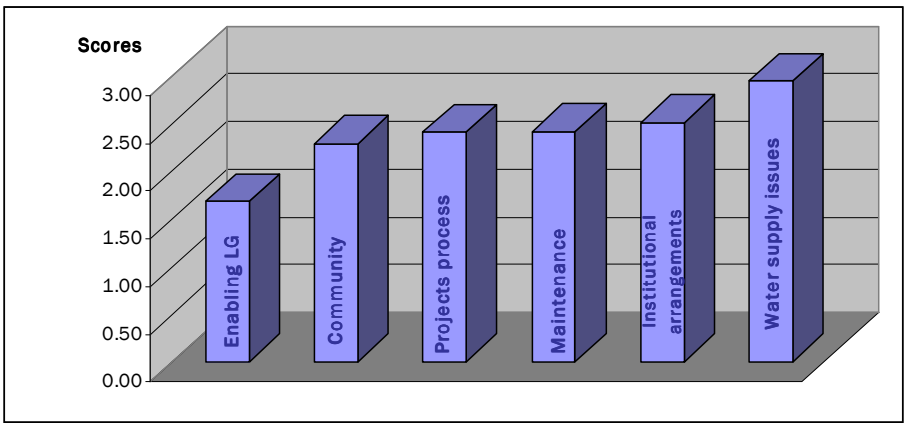
2.3 Influence of specific and contextual aspects of O&M over sustainability

Based on the survey's results, it's possible to compare how influential are specific and contextual aspects over sustainability. Before describing such trends, I'll briefly explain these aspects (Harvey et al 2004) (Helmsing 2001):

- Specific aspects:
  - **Water supply issues:** Refers to uses given to water, its quality and the source's reliability, to how users perceive value for money and meeting community water volume needs.
  - **Maintenance:** Refers to available technical skills and equipment for minor and major repairs, as well as preventive and curative maintenance. It also refers to access to the spare parts supply chain.
  - **Project process:** Refers to the involvement of the Community during implementation of the project through participation and contributions to the project.
  - **Institutional arrangements:** Refers to existing management systems, performance of the CBO in terms of training, organizational capacity of the Community to respond to major breakdowns and monitoring by an external agency.
  - **Community:** Refers to access or exclusion of Community members to the borehole, its impact on life quality, user satisfaction, and hygiene awareness. It also refers to the Community member's awareness of technology choice and perceived ownership over O&M.
- Contextual aspects:
  - **Enabling Local Government**: Refers to LG issues in respect to the CBO in charge of O&M: legal recognition, budget provisions, co-management of funds, administrative mechanisms, political representation, political weight, stimulation of O&M, place of planning for boreholes and their O&M in LG's planning, and convergence of actors involved.

Regardless of the category (A, B, C), figure 8 shows specific and contextual aspects' average scores in relation to O&M:

Figure 8: Specific and contextual aspects' scores in relation to O&M



Source: own construction

The highest ranking specific aspect is water supply issues, contrasting with the enabling Government as the uniformly lowest .Community and project process rank among the lowest, and also below the median.

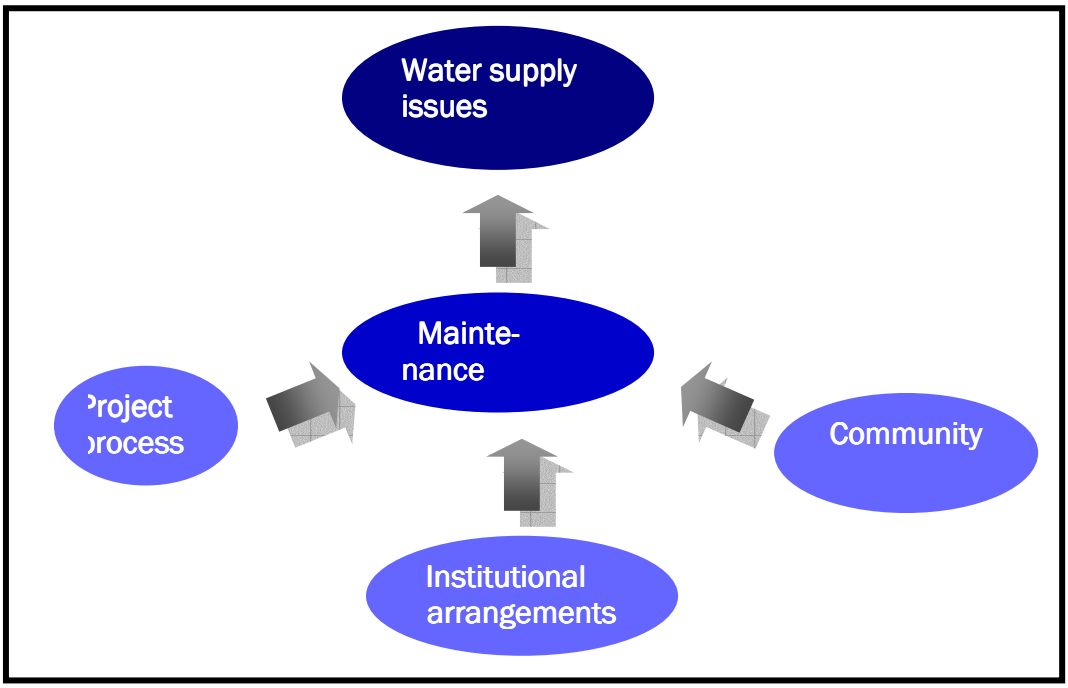
2.3.1 Linking sustainability to specific aspects of O&M

Based on the survey's results, it is possible to compare how influential are specific aspects in relation to water supply issues, which as the main outcome, determines how successfully the water facilities are being used by target population, as well as its found usefulness, which is the main purpose of borehole projects.

I will first analyze the relation of maintenance to water supply issues, and then the relation of project process, institutional arrangements and community issues to maintenance, as its independent variables that influence successful sustainability.

Figure 9 graphically describes the relations to be analyzed:

Figure 9: Specific aspect's relations



Source: own construction

The relations will be analyzed using the rank correlation coefficient (rs)[3], which will determine the significance of their relations and how influential are independent variables over the dependent variables of maintenance and water supply issues. Table 4 shows values for rs:

Table 4: Values for rs

Relations	rs	Significance level
Water supply issues and maintenance	0.36	(>0.05)
Maintenance and project process	0.55	(<0.01)
Maintenance and institutional arrangements	0.74	(<0.01)
Maintenance and community	-0.03	n.a

Source: own construction

[3] See annex V for procedure of calculation of rs

Interpretation of rs indicates that:

- A positive correlation exists among the dependent variable of water supply issues and the independent variable of maintenance, so water supply issues' sustainability tends to increase as maintenance improves. Testing for chance association, with a sample of 20 observations, a value for rs= 0.37 is required for the 0.05 level of significance, so there's less than a 95% confidence that there's a significant positive correlation between water supply issues and maintenance for the 20 projects. This statistical calculation means that maintenance indeed positively influencing water supply issues.
- A positive correlation exists among the dependent variable of maintenance and the independent variable of project process, so maintenance's sustainability tends to increase as project process' issues improve. Testing for chance association, with a sample of 20 observations, a value for rs= 0.53 is required for the 0.01 level of significance, so there's a 99% confidence that there's a significant positive correlation between maintenance and project process for the 20 projects. This statistical calculation means that project process indeed is positively influencing maintenance.
- A positive correlation exists among the dependent variable of maintenance and the independent variable of Institutional arrangements, so maintenance's sustainability tends to increase as project process' issues improve. Testing for chance association, with a sample of 20 observations, a value for rs= 0.53 is required for the 0.01 level of significance, so there's a 99% confidence that there's a significant positive correlation between maintenance and project process for the 20 projects. This statistical calculation means that institutional arrangements are positively influencing maintenance.
- A negative correlation exists among the dependent variable of maintenance and the independent variable of Community, but it's not statically significant, because variation in community values is too low.

2.3.2 Linking sustainability to contextual aspects of O&M: the enabling Government

Data collected for the enabling Government aspect has no variation among the projects of the case study, since they fall under the same Local Government district. A comparative analysis among sub aspects is interesting to find out how ranking is distributed, and how it influences O&M. Figure 10 shows such ranking.

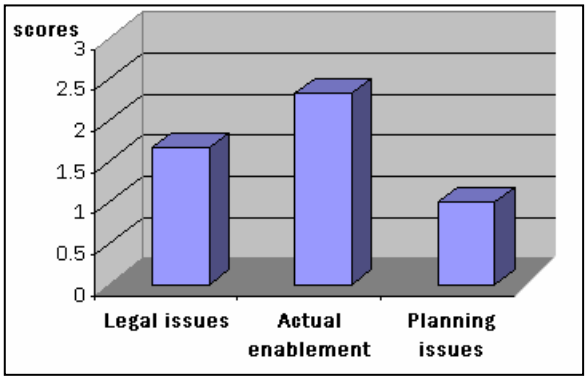


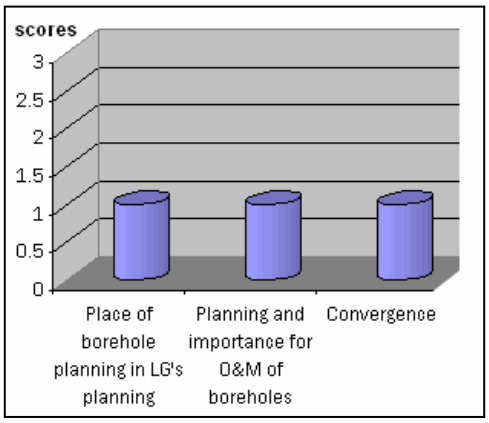
Figure 10: Ranking of sub aspects of the enabling Government

Source: own construction

Planning issues ranks as the lowest, followed by legal issues, and actual enablement is the most successful sub aspect. I will now draw observations on these categories, starting form the lowest.

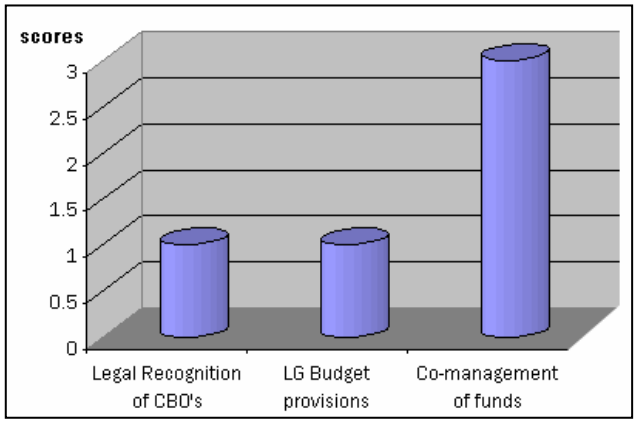
- **Planning issues:** Within this sub aspect, convergence, place of planning for boreholes and their O&M in LG's planning and the importance attached to it by LG's had exactly the same scores, and also the lowest possible in the 1-3 scale. This means that there is no contact between LG and CREDO, and that the LG did not include the borehole project and its O&M in its plans for provision of water. These rankings are shown in figure 11.

Figure 11: Planning issues



- **Legal issues:** Issues concerning co-management of funds yield a high score, meaning that there is a law that empowers the CBO to collect and spend funds for O&M. On the other hand, legal recognition of CBO's and LG budget provisions rank among the lowest values of the 1-3 scale, meaning that the CBO is not registered at LG, and that the latter does not have a budget to support O&M, respectively. These rankings are shown in figure 12.

Figure 12: Legal issues



- **Actual enablement:** Within this sub category, administrative mechanisms and political weight of CBO's rank in the highest values possible of the 1-3 scale, meaning that there is always a unit or person in the LG to support the CBO towards implementation and O&M of the borehole, and there's a direct responsible for it. It also implies that the LG involves the CBO in decision-making processes related to boreholes. Stimulation for O&M ranks in second place, which means that there's knowledge in LG on procedures for O&M of boreholes but it does not reach the CBO. And finally, political representation ranks as the lowest, meaning that the CBO is not politically represented in the Local Government. These rankings are shown in figure 13.

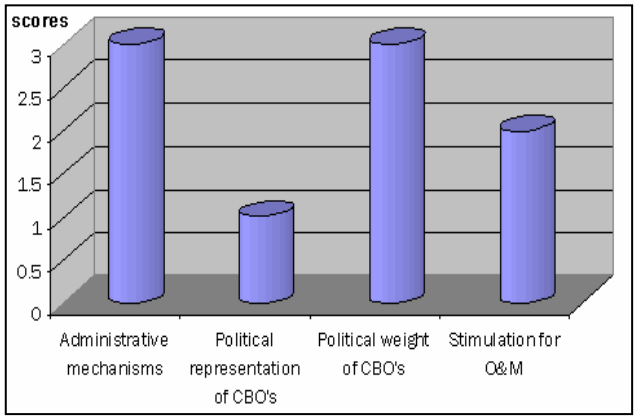


Figure 13: Actual enablement

Sources: own construction

Chapter III
The enabling government and its relation to sustainability of projects of the case study

3.1 The enabling Government and "scaling up" community management

A general question comes into mind when shedding light over findings of the case study in respect to the concept of the enabling Government: how do they compare with existing trends in literature on the subject?

To do so, I will provide a synthetic overview of the concept of the enabling Government and its links to the concept scaling up community management.

Sustainability as previously defined indicates implicit contextual factors that heavily influence its success, some of them related to the public sector: "The public sector has the mandate, tools and responsibilities to ensure that existing capacities, whether in communities, NGO's, government agencies or in private enterprises, can be brought together to serve Communities…to ensure sustainable community managed water supplies" (Schouten et al 2003:128).

The concept of the enabling Government helps to analyse actions and interactions of actors involved in water supply projects, affecting or promoting sustainability "This role [of enabling Government] does not lie in the direct provision of housing…but rather in facilitating and regulating the overall framework within which other actors can make their most effective contribution" (Helmsing 1997).

If we think of boreholes not only as projects, but as a continuous service, which should be a strong point of departure in any attempt to improve their sustainability, the concept of the enabling Government becomes more important: "There is, therefore, a need for a paradigm shift from projects to programmes, and from facilities to services" (Harvey et al 2004:xix).

And finally, the concept of enabling Government refers to necessary organizational changes:"…ii) allocation of funds in Government regular current and capital budgets for CBO's and community participation and management activities" (ibid).

Latest trends in rural water supply point at community management, whose role is enhanced through the enabling Government in the case of infrastructure provision in the sense that "Community organizations are seen as extended arms to collect user charges and to mobilize investment financing" (ibid).

I refer to the enabling Government as the most influential contextual factor over O&M relying on current trends on the debate of rural water supply, that points directly at "scaling up" community management as a "key issue of the day…in development programs" (IRC 2004: 16). To understand the relation among both concepts, it is necessary to elaborate on the latter.

Scaling up can be considered an extension or operationalization of the concept of the enabling Government towards rural water supply: "For Community management (of water projects) to be 'scaled up' requires attention not only to the community but also, and as importantly, to the enabling environment in which the community exists: the laws, policies, institutions and actors who support and build on the community's own capacities…Scaling up requires different approaches to implementation, specially a move away from projects towards a service

delivery approach" (Lockwood 2004:19).

To answer the initial question on trends in literature referring to O&M, I'll provide a brief deduction and analysis of the observations drawn from data on chapter III, as a synthesis of findings and theoretical reflections on the concept of the Enabling Government.

3.2 The enabling Government and the generic parts of O&M.

The findings:

3.2.1 On the existence of a Management Committee responsible for O&M:

- *The existence of a community organization formed for the purpose of O&M management, opposed to an already existing organization, positively influences sustainability.*

One must be careful with this deduction because it contradicts the fact that implementation of projects should take advantage of already existing community organizations instead of promoting the creation of parallel ones, as it has become common knowledge in implementation of projects through CBO's.

It could acquire a logical sense in search of "indefinite sustainability" (IRC 2004: 1): by creating a new, exclusive community organization to bear the complexity that O&M implies, a higher sense of ownership is generated and therefore sustainability is improved.

However, this finding can not be taken for granted as a general conclusion beyond the area of the case study's projects, because of implicit bias related to the size of the sample. Moreover, literature points out that successful sustainability is more dependent on O&M being community-driven, rather than Government-driven, with no particular focus on new or already existing CBO's, as evidenced in current trends for water supply: "community management is now well established and is strongly advocated by …a range of other institutions involved in the sector (of water)". (Lockwood 2004:3).

Furthermore, it is even more important the supporting context in which CBO's become in charge of O&M, since ultimately in practice, oftentimes it is communities that are leading enablement towards O&M : "Local Governments don't lead enablement, at best they follow it, if at all" (Helmsing 2000: 17).

3.2.2 On the ownership of the borehole and the plot where it is built:

- *Ownership of the borehole by all community members opposed to only committee members improves levels of sustainability, as well as ownership of the plot by the community or a person, as opposed to ownership by an organization.*

Local ownership can't be created by donor's interventions (De Valk et al 2005: 1). Allowing the Community to choose how ownership will take place is a positive strong point of departure. Nonetheless, choosing ownership by all members of the community could be a practical response to the lacking legal recognition of the CBO and its political representation in LG.

However, the community exercises property rights over the borehole, as evidenced by the high score of water supply issues. This means that people is close to giving full use to the water source and that they rely on it for meeting their needs : "as the value of common property increases, people are more likely to establish rights over it" (Barzel 1989:65), which reinforces ownership: "ownership of objects can

be equated with property rights" (De Valk et al 2005:8).

Nevertheless, since boreholes are on the public domain, rights are not perfectly delineated, which hinders communities from different options for O&M, they are induced into taking a "choice not to exercise all of their rights" (ibid). Although full delineation of rights would be expensive for the LG, it would have valuable advantages for the CBO, lightening weight off the shoulders of LG, boosting options for O&M management: "a person's ability to realize the potential value of his/her property depends on the extent of her or his property rights, which consists of the ability to use (and to exclude), to alienate, and to derive income from the property. (ibid: 85).

Clear delineation of rights opens up possibilities for different modalities for O&M, as argued by Hernan de Soto: "where ownership and transactions are clearly recorded, there is greater independence for individuals from local community arrangements to protect their assets". However, whether by the CBO or all community members, if ownership stays within the community, then achieving success in O&M is facilitated, according to current trends in analysis of water supply: "Local ownership as a key factor in achieving project success…strong local ownership can contribute to sustainability" (De Valk et al 2005: 1).

Multiple ownership (by all members of the Community) seems problematic, but "appreciating it can be productive" (ibid:4), as evidence from case study points out. Furthermore, a sense of ownership by community members could be considered more influential in successful sustainability than the actual legal ownership: "Although formal legal ownership of…infrastructure is highly desirable, it's not always possible…of equal importance is a sense of ownership" (Lockwood 2004:8).

This, by implication, supports how POOM is not affected by lack of ownership. Furthermore, since community is likely to pay for O&M, although the facility is not legally owned, they exercise rights over it as costumers.

3.2.3 On repairs, supply of spare parts and time consumed in repairs:

- *Key aspects in findings related to higher levels of sustainability are: access to different options for O&M, shared responsibility over supply of spares, and the private sector performance being affected by scarcity of private operators involved.*

Ownership of O&M is as influent for sustainability as ownership of the project itself: "Ownership and responsibility are the key prerequisites for sustainable O&M" (Brikké 2000:45). Moreover, ownership of O&M can be compared to ownership of project process as elaborated by De Valk et al: "owning the project also implies the possibility of owning the processes that take place in planning and managing the project…owning the capability to deal with these (mostly market institutions) becomes an essential part of owning project processes".

Ownership over O&M widens access to different options, including shared responsibility with other actors, which in itself, although at first at fist glance might seem prejudicial for the community since it can imply confusion or at the end having no one responsible at all, can represent advantages if the proper environment is provided.

In this sense, widening the options from where the community can draw resources to carry on repairs is matched with the "enabling of Communities" as a feature of the enabling Government (Helmsing 2000:11), which ultimately would lead to better choices made by

Communities, and therefore, improving sustainability.

The enabling Government indicates moving from discussing "what poor people need" to "what access to resources…should low income people have to allow them to ensure their needs are met…and their priorities addressed" (Helmsing 1997: 112); so widening access to options of O&M is indeed more important than fostering access to only one.

In respect to shared ownership over repairs and spares, the concept of "co-ownership" (De Valk et al 2005: 12) of "management of processes" (ibid:6) as an area of ownership, might explain why sustainability of boreholes might be improved through this scheme: "multiple ownership can take the form of co-ownership when individual parties fruitfully cooperate along different incentive structures to achieve project success". In a case study of projects implemented by the Swedish cooperation in seven countries, it was observed that local parties valued co-ownership of project processes with the international cooperation, because they acquired knowledge in the process and autonomy levels were respected (ibid: 12). This study concluded that "co-ownership is positively desirable since it ultimately reinforces local ownership…ownership doesn't have to be exclusively local" (ibid: 18).

In the case study's projects, higher levels of sustainability are linked to having more than one actor responsible for O&M, mainly: the village mechanics, the health care centre worker or someone from the private sector. Cooperation among all these actors reduces time for repairs of breakdowns. Still, findings in respect to shared responsibility over O&M in the case study can't be generalized, because blurring of responsibilities is commonly considered as ending up in inefficiency, and interferes with the operationalising of the enabling Government, as indicated by Stoker: "The blurring of boundaries between public, private and voluntary actors creates ambiguities and uncertainty among policy makers" (Helmsing 2000: 21).

Nevertheless, coordination and respect for autonomy of actors involved lead to opening up options for repairs and spares, instead of looking solely into a CBO or the private sector as responsible, due to its scarcity. Actions an interactions of suitable actors are key factors for achieving sustainability, with the support towards community enablement from LG: "The question ceases to be one of either community or Government, but rather one of identifying and matching the capacity and potential of Communities to manage, with the capacity and potential of Government agencies for planning and support" (Lockwood 2004: 26).

3.2.4 On origin of funds for O&M:

- *Funds coming from the Community, organized through the MCC are likely to improve sustainability and decrease time necessary to conduct repairs and acquire spare parts, as opposed to funds coming from an organization.*

I will not go into deep analysis of this observation, since it is only logical to accept that funds coming from the Community foster a higher sense of ownership and therefore sustainability is improved: "a sense of ownership, brought about by paying for the system and its O&M…is crucial to the success of Community management" (Schouten et al 2003).

However, it is interesting to note that only in two of the twenty projects of the case study water is sold. This happens where the local church owns the borehole and uses income to pay for repairs. Both projects fall under group "C", mainly because they are at 90 and 15 km respectively away from the nearest repairman, which

highlights the issue of how scarcity of private operators affects sustainability, even more than lack of funds.

3.3 The enabling Government and the specific parts of O&M

The findings:

- *The highest ranking specific aspect is water supply issues, contrasting with the enabling Government as the uniformly lowest .Community and project process rank among the lowest, and also below the median.*
- *A positive correlation exists among water supply issues and maintenance, which in turn has also a positive correlation to project process and institutional arrangements.*
- *A negative correlation exists among maintenance and community, but it is not statistically significant.*

Water supply issues' highest ranking among all aspects indicates that the ultimate purpose of Community management is being comparatively achieved in terms of quality; reliability and usability of the water point.

Community issues' lowest raking is affected by the sub aspects of technology choice and hygiene awareness. The first aspect highlights the fact that communities are not consulted about the type of hand pump to be implemented, which affects ownership of O&M, given that "ownership of knowledge" (De Valk et al 2005: 12) is not being properly fostered.

However, the sub aspect of ownership of O&M ranked comparatively higher, which indicates that Community has a strong sense of ownership over O&M. This can be explained because of the type of hand pump implemented: the Volanta, which might be considered a "public domain hand pump" (S. Parry Jones et al 2001: 15), meaning that spares are available locally.

There's an ongoing debate over sustainability in respect of technology choice. As the case study shows, public domain hand pumps facilitate community ownership over O&M in isolated rural communities and consequently positively influence sustainability, but they are also of poor quality. Hence, the role of the enabling government towards supporting preventive O&M acquires importance.

For instance, in Mozambique, standards of the Afridev, which is also a "public domain hand pump", are assured by enforcing strict quality control procedures and carrying out independent third party inspections, by a university engineering department (ibid: 15). The LG could facilitate the "overall framework within which other actors can make their most effective contribution" (Helmsing 1997:108) as a function of the enabling Government. This of course would require "expanded regulatory (including monitoring) capacities of Government" (ibid), which is not a very strong facet of LG's in Burkina Faso currently, given that decentralization is still taking place.

Regarding project process, the fact that in all projects, community initiated the projects themselves contributes to high levels of sustainability. This is a well known feature of successful sustainability in community managed projects: involving the community from the beginning of the cycle of the project.

The role of the enabling Government could further improve this situation by promoting participatory approaches towards identification of projects, at national level, coped with sector-wide approaches to maximize efficiency in allocation of resources coming from national and international sources.

This is clearly illustrated in the case of Uganda, which is hailed as a model for scaling up rural water supply (Sinclair

2004:iv) : “the Government of Uganda was able to win the attention of many donor agencies…it basically involved moving from a project-based approach to comprehensive sector wide programmes. Donors would be encouraged to pool their funding into a “basket” and support wider sector programmes driven by national plans and objectives” (Ibid: 7).This added feature of the enabling Government copes perfectly with the suggested move from “systems to services” (IRC 2004:1) in search for improved sustainability.

Regarding capital contribution its low rank heavily affects average score of project process. This is because in most projects the community did not contribute in cash but in kind, and in some cases did not contribute at all, affecting sustainability as elaborated previously in the analysis of origin of funds for O&M.

As for institutional arrangements, the lowest levels of sustainability occur where there’s an active CBO in charge of O&M but it’s not managing the source satisfactorily, either because local people have not been trained or can’t remember or apply what was learned.

The fact that there’s no one trained in the community might be because of mobility of inhabitants of the villages, which is a disadvantage of VLOM as elaborated in chapter I. As for not remembering or applying what was learned, lack of planning for O&M from LG constitutes a missing link towards sustainability. The role of the enabling Government in “the incorporation of CBOs and corresponding areas in Government planning and administration” (Helmsing 1997:117) could help improve monitoring by local actors towards ongoing training for O&M, hence, scaling up community management.

And finally, maintenance issues are mostly affected by lack of enough funds readily available when repairs are necessary. Lower levels of sustainability also occur where preventive maintenance is not being carried out at all or not on a regular basis, which can also be attributed to lack of planning for O&M

It is interesting to note that in spite of scarcity of private operators, skills, equipment and spares are available for all repairs. This can also be attributed to the “public domain” type of hand pump used, as well as to the training and equipment provided by CREDO at the start of the project.

However, as community enablement should not be a reason for agencies to escape their role towards technical assistance, it should not be either a reason for LG to refrain from providing budgetary support: “support to communities relies more than just institutions…it requires certain mechanisms to be in place to allow these institutions to function properly… Budgetary support, financing mechanisms…” (Schouten et al 2003)

Moreover, funds raised only by the community should not be looked as an integral solution to the problem. CG should definitively, not be separated from its obligation to financially support local initiatives in self provision of such services. If the construction of a road or conditioning an export processing zone is carried on mostly with national funds, without asking transnational companies to contribute, who get huge benefits out of it, why should the poorest families be compelled to shoulder the burden of paying for basic services alone? (Bliss 2005). Governments should support local initiatives as legitimally and effectively as they support private sector initiatives, for it is one of its core functions that shall not be neglected just because it doesn’t generate high returns.

This is where the role of the enabling government towards community enablement shines: it allows and fosters contributions from available

actors towards best allocation of resources (Helmsing 1997: 108).

3.4 The enabling Government and different modalities of O&M

Decentralization processes in Burkina Faso are still taking place, which leaves room for an enabling Government to grow towards sustainability of boreholes: "decentralization is seen by many, albeit sometimes for different reasons, as one of the cornerstone of enablement" (Helmsing 1997: 123). Given that the case study's projects are mostly VLOM, there's a strong need for operationalisation of the enabling government towards communities: "Where they (community management and decentralization) meet is somewhere…typically around the level of District or Municipality Government. Both community management and decentralization…cannot do without each other" (Schouten et al 2003: 133).

It is possible to argue that the operationalisation of the Enabling Government is not exactly taking place in Burkina Faso, as evidenced in the case study by its comparatively low score. How is this affecting sustainability? It is interesting to analyze it through the three sub aspects of the Enabling Government, starting from the one with the lowest score:

- **Planning issues:** The fact that there is no contact between LG and CREDO for the implementation of the projects could be hindering CBO's from getting technical support towards O&M. There are fewer possibilities that CBO's could rely on LG's alliances with financial institutions, universities, agencies, other governmental dependencies, etc., in order to widen access to options, which is a key aspect towards sustainability. Given that LG does not include the projects in its plans for water provision leads to having lower chances to promote convergence of actors that would lead to later support in O&M, which in turn would promote "indefinite sustainability" (IRC 2004: 1)
- **Legal issues:** the fact that the CBO is not registered and legally recognized by the LG has negative consequences for establishing partnerships with other actors, also for defining rights and supporting ownership towards the project and its O&M. Nonetheless, property rights seem to be established. This is not the optimal condition for O&M, further evidenced by the fact that there's a law that empowers CBO's to collect and spend funds for O&M, but since the CBO isn't registered in the LG, and LG has no budgetary support towards O&M, the CBO is in no position to experience benefits derived from legal recognition of property rights.
- **Actual enablement:** Although LG supports O&M and decision making through a direct responsible in its offices, available knowledge on O&M in LG's does not reach the CBO, further affected by the lack of contact with CREDO during implementation of the project. This hinders the potential to improve sustainability by activating already existing policies and administrative structures towards enablement of CBO's in LG.

It is interesting to reflect theoretically on how the role of the enabling Government would positively influence sustainability in respect to different modalities of O&M.

Since VLOM relies heavily on Communities' skills, it is logical to think that regulation from the LG is in demand mainly for: "scaling up" community management, convergence of actors to facilitate training and access to the spare parts supply chain,

and standardization of technology choice.

Policies for promoting public domain hand pumps and strategic alliances to gain access to the international supply of spares chain would help overcome limitations of CBO's on this matter.

Community enablement as "a strategy by Government to coordinate and facilitate the efforts of CBO's" (Helmsing 1997:110), within the enabling Government, should compliment efforts from communities towards O&M of their projects, which is heavily affected by the "Lack of legislation, policy and support structures…of a helping hand, of a legal framework to support community management…of adequate resource legislation…" (Schouten et al 2003: 159).

As discussed before, ownership of the borehole is crucial for community management in search of sustainability, thereupon, legislation for definition of property rights towards the borehole should be also a priority for the enabling government in VLOM: "who owns or can own water supply systems and what rights and obligations go with the ownership…starting form communities internal regulations…going up to laws and policy guidelines regulating and guiding staff" (ibid: 160).

Regarding PPOM, given that it implies complex relations among CBO's and other actors, a call for the enabling government to expand and refine its regulatory framework towards such complexities is required: "Involvement of other parties in the provision of infrastructure services requires an expanded regulatory capacity of the Government" (Helmsing 2000: 20).

The role of other actors should be well defined, for instance, agencies that provide support to the community or the informal private sector, which constitutes "A crucial part of an enabling environment…to ensure a maintenance contract is carried out properly" (Schouten et al 2003: 159).

Being that some responsibilities towards community management of O&M have been shifted to the private sector, the LG should build efforts for regulation towards legal recognition and skills' building for CBO's, especially regarding their contracting abilities.

Policies towards promotion of closer interaction among actors and involvement of the private sector, both local and international, must take place to gain access to the supply chain for spare parts; by capacity building for the first and establishment of strategic alliances with the latter. In this sense, market enablement should foster "encouraging entrepreneurship, skills and innovation, leading to increase in the supply of goods and services" (Helmsing 1997:108).

However, regulation of prices should be strongly implemented in order to build credibility of the private sector. Furthermore, legal recognition and registration of CBO's, to promote the exercise of their legal rights and the construction of reliable alliances and partnerships with the private sector is necessary, given that partnerships and alliances as a feature of market enablement, facilitate access to the spare parts supply chain: "Public-private partnerships can mobilize more resources, reduce risk and can contribute to economies of scale in production" (ibid: 117).

And lastly, POOM involving the private sector as the main supplier, demands strong regulation for prices and financing mechanisms to support communities enter the private market successfully. Market enablement in this case should focus on "market efficiency, the state letting markets work where they can" (Helmsing 1997: 108), with the back up of convenient policies towards strengthening communities' income levels, through convergence of actors.

For instance, the infrastructure program in Honduras, Central America,

which offers micro credit to communities for basic services facilities, has defined as an initial requirement, that the Local Government subscribes an agreement with the CBO for technical assistance and free supervision during implementation of the project. In this way, quality in technical aspects is assured, and the community is also financially supported by the LG, since individual amounts for credits are reduced.

However, scarcity of the private sector might hinder effectiveness of such policies, although it can be helped by clustering of projects through a more active role of LG in strategic planning of boreholes.

Could it be that poorest communities are left behind and then market enablement doesn't work for POOM? Not likely, as explained in chapter I, there's an array of possibilities for communities to overcome lack of funds to pay for O&M, which coupled with an enabling government can help overcome this aspect.

For instance "subsidize lending" (ibid: 114), as a feature of market enablement towards the housing sector, provides long-term financial stability to communities. Furthermore, there's strong evidence in Uganda about the involvement of the private sector in water supply as a crucial element for success, coupled with an active enabling Government: "The decision to use the private sector as the main implementing agency has permitted the government to focus on their new role, providing regulation, support and financing to the sector" (Sinclair 2004: 19).

Chapter IV
Conclusions

It is considered that for water supply systems to be sustainable three actions from the LG have to be rightly in place: "instilling a sense of ownership, promoting participation and sharing costs" (IRC 2004: 1).

In the case study, although property rights have not been legally recognized, they are actually taking place, manifested in ownership of the borehole and its O&M, which of course is not an optimal situation. Participation is being promoted but has potential to improve, as evidenced in the generic aspect of community issues, which ranked as the lowest. Lastly, sharing costs related to O&M is definitively taking place, as observed in projects under the modality of the health care centre and those in which the local church is involved, which positions projects in medium or highest levels of sustainability.

It is then possible to establish the connection among the enabling government and projects of the case study. Regulation for legal recognition of CBO's and property rights over the borehole, as well as fostering of strategic alliances with other actors, and promoting clustering of projects to generate higher density is highly in demand, which could be achieved through a sector wide approach for strategic planning of rural water supply.

It is also interesting to note, that although the projects are operating mostly under VLOM modality, evidence shows that there's still potential for improvement by legal recognition and delineation of property rights towards CBO's, which ultimately opens access to a wide array of options: "Community management is about power and control…they make strategic decisions: what level of service they want, how they want to pay for it and where they want it" (Lockwood 2004: 7).

Thoughtful implementation of community enablement in VLOM and market enablement for PPOM and POOM by the LG offers a chance to improve sustainability of borehole projects, coupled with "scaling up" community management, ultimately leading to getting closer to MDG's in relation to water.

Of course implementation of such policies is not free of constrains, mainly due to recent implementation of decentralization processes in Burkina Faso. Decentralization constitutes a "cornerstone" (Helmsing 1997: 123) for the enabling government to effectively take place, especially for VLOM approaches towards water supply, which are currently being widely implemented.

However, it is interesting to note that present trends in the water sector keep promoting community management, as evidenced by the current weight of "scaling up" community management. But a question remains: why mostly VLOM? Experiences in Uganda have shown that incorporation of the private sector as the main implementing actor within a supporting enabling environment has lead to significant improvements in water supply (Sinclair 2004:19). Moreover, PPOM and POOM represent substantial advantages over VLOM, as I have tried to show in this paper, as well as disadvantages. But the disadvantages can be strongly overcome by getting the right support from the Enabling Government and scaling up community management.

Perhaps it would be equally interesting and useful to promote water supply projects in PPOM and POOM modalities that would implicitly promote effective convergence of other actors,

such as the infrastructure program in Honduras mentioned before.

LG's have potential to foster and promote alliances among CBO's and existing agencies, the private sector and technical sub units of LG's; by establishing policies that would lead implementing agencies towards community and market enablement, given that appropriate skills were in place.

However, it can be argued that the presence of LG is weaker in rural areas, which leads to neglect of interventions, the water sector included. This fact makes the encouragement of involvement of LG in rural water supply all the more important, since enablement of communities within an environment where they can establish relations with other actors, having been provided with legal status to encourage getting the most of linkages and possible partnerships among actors involved is vital.

An equally important issue is that, given the complexity of relationships among CBO's and other actors in search for improved sustainability, the LG needs to have strong coordination skills, which might not be easy to achieve: "Governance therefore needs systematic co-ordination by negotiation…for steering the development of the network (of actors). This remains a role for Government, but as we noticed earlier, as an enabler, it can only do so imperfectly" (Helmsing 2000:21).

What modality of O&M is more convenient in search of improved sustainability? All this argumentation has tried to confirm that scaling up community management is crucial in either modality, as long as the right enabling Government in the dimensions of community and market enablement is put in place, trough planning, legal and administrative operationalization of it.

It has also tried to suggest that there is both potential for growth in the case study projects as well as strong factors that would hinder sustainability if engagement in other modalities than VLOM was to happen. Tackling water scarcity and sustainability of borehole projects implies a matter of choices depending on available resources: are implementing agencies willing to deal with the LG towards supporting community and market enablement? Is the LG wiling and skilled to demand strategic alliances with the private sector? Is there a favourable market to promote PPOM? Are micro finance institutions willing to engage on schemes involving productive activities plus activities that do not immediately conduce to boosting income such as water supply? Would they get support from LG? Answers to all this questions can be found if rural water supply is implemented through a more holistic approach towards all actors involved, both from agencies and as a feature of the enabling Government, for strategic planning and managing of O&M of boreholes.

The water decade calls for "global governance: unless water concerns are integrated within broader national and international processes of trade, stability and a more equitable government, the chances of achieving international water targets remains poor" (UN 2006b: 8). Like most developmental interventions, the answer as on which approach to use to benefit its clients, the habitants of isolated rural communities in this case, should also lie on proper support and global enablement of Governments from the international actors of the water sector, coupled with current focus on community enablement towards improving sustainability: "development is at once…a political problem, a political issue; and a political process. To get development right, it is necessary to get the politics right" (Goldsworthy1988:526).

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Annex I: References for further reading on O&M sub modalities

Modality	*Further reading*	*Example*
VLOM		
1. Community volunteers	*Pages 170-171 in http://www.wedc.ac.uk/projects/shp/index.htm*	*A case of VLOM in Malawi (Pages 7-23) in: http://www2.irc.nl/pdf.php3?file=manage/csmalawi.pdf,*
2. Area pump mechanics	*Page 171-172 in http://www.wedc.ac.uk/projects/shp/index.htm*	*A case in Afghanistan, page 402 in: http://wedc.lboro.ac.uk/conferences/pdfs/32/Vijselaar.pdf*
3. Circuit riders	*Pages 172-173 in http://www.wedc.ac.uk/projects/shp/index.htm*	*An example in Honduras, Central America: Pages 39-43 in: http://www.irc.nl/content/download/23458/267858/file/OP40-E.pdf*
4. Water user groups	*Pages 77-78 in http://www.wedc.ac.uk/projects/shp/index.htm*	
5. Community partnerships	*Pages 1-4 in (also an example in India): http://www.wsp.org/filez/pubs/426200710142_Community_Partnership_in_O&M,_Meerut.pdf*	
7. Agency and Community Partnership	*Pages 53-54: http://www.irc.nl/content/download/2566/26510/file/op29e.pdf*	*A case in Indonesia with intervention of CARE : Page 56 in: http://www.irc.nl/content/download/2566/26510/file/op29e.pdf*
PPOM		

1. Bidding for least subsidy approach	*Pages 175 in:* *http://www.wedc.ac.uk/projects/shp/index.htm* *And:* *http://siteresources.worldbank.org/INTWRD/Resources/Patricia_Veevers_Carter_WorldBank_Output_Based_Aid_Approaches.pdf*	*A case in Uganda: http://siteresources.world-bank.org/INTWRD/Resources/Carsten_Glenting_COWI_Out-put_Based_Aid_for_Wa-ter_and_Sanitation_in_Africa.pdf*
2. Total warranty scheme	*Page 31 in (also an example in Mauritania) :* *http://wedc.lboro.ac.uk/projects/proj_contents/WEJW2%20-%20Handpumps/www/outputs/Literature%20Review.pdf*	
3. Water assurance scheme	*Page 176-177 in:* *http://www.wedc.ac.uk/projects/shp/index.htm*	*A similar case in Kenya: A member-ship scheme, pages 27-28 in: tp://wedc.lboro.ac.uk/projects/proj_contents0/WEJW2%20-%20Handpumps/www/out-puts/Kenya%20Report.pdf*
4. Government Maintenance Con-tract	*: Page 177 in:* *http://www.wedc.ac.uk/projects/shp/index.htm*	
5. Manufacturer-NGO model	*Pages 43-44 in:* *http://www.wedc.ac.uk/projects/shp/index.htm*	
6. Primary health care model	*Pages 44-45 in (also an example in Liberia):* *http://www.wedc.ac.uk/projects/shp/index.htm*	
7. FRUGAL	*http://www.wsp.org/filez/activity/823200794656_Forming_Rural_Utilities_Groups_and_Leases_(FRUGAL).pdf* *And page 3 in:* *http://www.wsp.org/filez/activity/823200794656_Forming_Rural_Utilities_Groups_and_Leases_(FRUGAL).pdf*	
8. Leasing	*(Also an example in Angola) :* *http://wedc.lboro.ac.uk/conferences/pdfs/27/vanBeers.pdf*	

9. Short term O&M contracts	*Pages 8 and 34 in (also an example in Uganda): http://siteresources.worldbank.org/EXTWSS/Resources/ENGAGING_LOCAL_PRIVATE_OPERATORS.pdf?resourceurlname=ENGAGING_LOCAL_PRIVATE_OPERATORS.pdf*	

POOM

1. Individual ownership	*Page 30 in http://wedc.lboro.ac.uk/projects/proj_contents/WEJW2%20-%20Handpumps/www/outputs/Literature%20Review.pdf. Also http://www.skat.ch/publications/prarticle.2005-09-29.5069774463/prarticle.2005-09-29.1875579521/skatpublication.2006-09-05.1216732103/file*	*A self-supply initiative in Uganda: Page 19 in http://www.rwsn.ch/documentation/skatdocumentation.2005-11-17.7461089382/file*
2. Lease	*Page 180-181 in : http://www.wedc.ac.uk/projects/sh p/index.htm*	*Page 178 in: http://wedc.lboro.ac.uk/conferences/pdfs/32/vanbeers.pdf*

Annex II: Survey conducted for case study

Sustainability Snapshot for borehole Projects

Instructions for filling the O&M questionnaire

Generalities

Operation & Maintenance (O&M) are actions intended to have the borehole working continuously in good shape, for the benefit of the community; like regulating who can use it, taking care of it, collecting contributions from the community for purposes related to the operation of the borehole, establishing contact with the Local Government to find support, repairing it, calling or contracting someone who can repair it; etc. It's important to note that O&M is more than just repairing the borehole when it breaks down; it's also about preventive maintenance, which consists in carrying out all activities mentioned before as a routine, to prevent the borehole from breaking and falling into disrepair and disuse.

Section I

The following instructions are intended to explain what we seek to find out trough each of the questions posed in the O&M questionnaire. Please read them carefully along with the questionnaire before implementing it.

Question a): CREDO forms a "management committee" for each borehole implemented, training its members in use of the pump. This question seeks to find out if that committee still exists and operates, and if it does, how many members it has and how many of them are women.

Question b): This question seeks to find out who is in charge of O&M of the borehole. It is very important to establish who, if there's someone, is responsible for the O&M of the borehole, because the rest of the questionnaire has to be answered with that "someone" in mind. First, we want to know if it is a person, an organization or the Management committee formed by CREDO. Then, we want to know where it comes from; it might be from the community, the Local Government, from an NGO or from the private sector. And finally, we want to know how many members it has and how many of them are women.

Questions c) and d): Who owns the borehole and the plot where it is built? First, we want to know if it is a person, an organization or the Management committee formed by CREDO. Then, we want to know where it comes from; it might be from the community, the Local Government, from an NGO or from the private sector.

Question e): This question seeks to find out if the borehole has had breakdowns making it fall into disrepair lately, and for how long it has been out of use, at least for the last time it happened.

Question f): It's important to note that who makes the actual repairs is different from who is in charge of O&M. This question seeks to find out who makes the repairs. It is important to note that it might be from more than one of the options given. First, we want to know if it is a person, an organization or the Management committee formed by CREDO. Then, we want to know where it comes from; it might be from the community, the Local Government, from an NGO or from the private sector.

Question g): This question seeks to find out where does the money for reparations and expenses dealing with O&M of the borehole come from; it is important to note that it might be from more than one of the options given. First, we want to know if it is a person, an organization or the Management committee formed by CREDO.

Then, we want to know where it comes from; it might be from the community, the Local Government, from an NGO or from the private sector.
Question h): This question seeks to find if out, in case the community doesn't make any contributions, whether they would be willing or not to pay for O&M of the borehole.
Additional comments: This space is for any observations or commentaries that might explain other issues related to the questions posed before, to help us understand better the situation of the particular borehole.

Sections II trough VI
They are self-explanatory

Section VII: the enabling government
This section seeks to find out about the performance of the Local Government with respect to implementation and O&M of boreholes, how it intervenes and supports the CBO in charge of O&M in respect to their needs towards the borehole, for planning, implementation, O&M of the borehole and also for establishing contact with CREDO.
It is important to note that all the questions are posed with respect to the person, CBO or management committee identified as responsible for O&M of the borehole in section I, question b).
This section seeks to find out the following:
Legal issues:
- If the CBO in charge of O&M has been legally recognized by the Local Government, and if it has been granted with powers to sign legal contracts, for example, with a local company that provides spare parts or regular supervision of O&M of the borehole, without the intervention of the Local Government.
- If the Local Government has, within its budget, funds to carry on O&M of boreholes.
- If the Local Government legally empowers the CBO to collect funds for O&M, and if it also allows the CBO to use those funds.

Administrative issues:
- If there is a person or a unit responsible for support to the CBO in O&M of the borehole, and if there is somebody who has that direct responsibility within the Local Government.
- If the CBO has political representation in the Local Government.
- If the CBO has political influence in the Local Government.
- If the Local Government is involved in technical aspects related to O&M of boreholes and if it shares that information with the CBO to achieve better O&M of boreholes.

Planning issues
- If the Local Government included the project within its annual, regional or local plan for provision of water. If it didn't, then we want to know if the Local Government knows about the implementation of the project.
- If the Local Government has plans for O&M of boreholes, and if the CBO is included when the process of planning takes place.
- If the Local Government is in contact with CREDO and if it adjusts to its requirements or vice versa.

Operation and Maintenace questionnaire

Name of the Village:

Year of implementation of the borehole:

This field instrument is to be filled by interview to the following people:

- Section I: a community member closely related to the operation of the borehole.
- Sections II to VI: preferably more than one community member closely related to the operation of the borehole.
- Section VII: a Local Government official.

The term CBO stands for "Community based organization", and the term O&M stands for "operation and maintenance". For each section, check the box that best describes the situation of the borehole and fill in the information where required.

Section I. General questions

a) Is the management committee formed at the beginning of the project by *CREDO* still in existence and/or operational? ☐ Yes ☐ No

- If yes, how many members does it have?_____
- How many are women? _____

b) Who is responsible for O&M of the borehole?

☐ The management committee formed by *CREDO* ☐ A person ☐ An organization

- Where is (s)he/it from?
  - ☐ The community ☐ An NGO
  - ☐ The Local Government ☐ The private sector
- If it is from the community, please indicate:
  - How many members does it have?_____
  - How many are women?_____

c) Who owns the borehole?

☐ The management committee formed by *CREDO* ☐ A person ☐ An organization

- Where is (s)he/it from?
  - ☐ The community ☐ An NGO
  - ☐ The Local Government ☐ The private sector

d) Who owns the plot where the borehole is built?

☐ The management committee formed by *CREDO* ☐ A person ☐ An organization

- Where is (s)he/it from?
  - ☐ The community ☐ An NGO
  - ☐ The Local Government ☐ The private sector

e) Has the borehole been in continuous operation and use during the last dry season?

Yes ☐ No ☐

- If not, for how long has it been out of use? _____

f) Who does the repairs and provides spare parts? (Check more than one if necessary)

☐ The management committee formed by *CREDO* ☐ A person ☐ An organization

- Where is (s)he/it from?
  - ☐ The community ☐ An NGO
  - ☐ The Local Government ☐ The private sector

g) Where does the money for repairs and spare parts come from? (Check more than one if necessary)

☐ The management committee formed by CREDO ☐ A person ☐ An organization

- Where is (s)he/it from?
  - ☐ The community ☐ An NGO
  - ☐ The Local Government ☐ The private sector

h) Would the Community be willing to pay for O&M of boreholes? Yes ☐ No ☐

Additional comments:

Factor	Statement
Section II.Project process	☐ The pump was 'given', community not offered chance to participate. ☐ Community was asked if they wanted to participate. ☐ The community initiated the project themselves.
	☐ Community did not make any financial or in-kind contribution towards pump. ☐ Community made significant in-kind contribution (set by the Project). ☐ Community made financial contribution (set by the Project).
Section III. Institutional arrangements	☐ No community organization has responsibility for the water source. ☐ Community has organization but is not managing the source satisfactorily. ☐ Community organization is actively managing the source to everyone's satisfaction.
	☐ No one in community received any training from the Project or government staff. ☐ Some people trained but cannot remember or apply what was learned. ☐ Useful training was provided which still benefits trainees now.
	☐ Community would not know what to do in event of major breakdown. ☐ No clear procedure, responsibilities unclear in case of major breakdown. ☐ Clear procedure - confident that pump would be quickly repaired in case of major breakdown.
Section IV. Water supply issues	☐ Water never used for drinking. ☐ Water sometimes used for drinking water, sometimes not. ☐ Water always used for drinking water.
	☐ All the people who use the pump perceive the water is not good for drinking. ☐ Some of the people who use the pump perceive the water is not good for drinking. ☐ Everyone who uses the pump perceives the water is good for drinking.
	☐ The water source yield is poor, people have to use other sources all the time. ☐ Sometimes (dry season) the yield is inadequate to meet everyone's needs. ☐ The water source always meets everyone's needs.
V. Maintenance	☐ Technical skills not available to community for maintenance when needed. ☐ Some technical skills available for maintenance and repairs, but not all. ☐ Technical skills for all maintenance processes and repairs readily available.
	☐ Maintenance equipment and spare parts not available. ☐ Some availability but not for all repairs. ☐ Equipment and spares available for all repairs.
	☐ No preventive maintenance being carried out on pump. ☐ Some preventive maintenance being carried out, but not regularly.

	☐ No funds readily available for maintenance when needed. ☐ Some funds readily available but not sufficient for most expensive repairs. ☐ Funds readily available and sufficient to cover most expensive repairs.
Section VI. Community	☐ Some people never get access to the pump when they want to use it. ☐ Some people sometimes do not get access to the pump. ☐ All the people who want to use the pump can gain access all the time.
	☐ There is no improvement in the community quality of life after the hand pump installation. ☐ There is some improvement but not sufficient to solve all water problems ☐ Quality of life of the community has substantially improved.
	☐ Community does not like the hand pump and would prefer other water sources. ☐ Like the hand pump but worried about sustainability. ☐ Happy with the hand pump and expect to be able to sustain it.
	☐ No one in the community is aware of the link between dirty water and diseases. ☐ People are generally aware of need to use water in a hygienic way but often ignore it. ☐ All the people are aware and use water in a hygienic way.
	☐ The Community wasn't informed about the type of pump to be implemented. ☐ The Community was informed and asked their opinion about the type of pump to be implemented. ☐ The Community chose the type of pump they wanted to be implemented.
	☐ The Community doesn't understand how to operate the pump. ☐ The Community understands how to operate the pump but doesn't know how to do repairs. ☐ The Community understands how to operate the pump and knows how to do repairs.
Section VII. Enabling Local Government.	*Legal Issues* ☐ The CBO is not registered in the Local Government. ☐ The CBO is registered in the Local Government but doesn't have legal power to sign contracts with private actors. ☐ The CBO is registered in the Local Government and has legal power to sign contracts with private actors.
	☐ The Local Government has no budget to support O&M of boreholes. ☐ The Local Government has sometimes a budget for O&M of boreholes. ☐ The Local Government has always a budget to support O&M of boreholes
	☐ There's no law that empowers the CBO to collect funds for O&M of boreholes. ☐ There's a law that empowers the CBO to collect funds for O&M of boreholes on behalf of LG. ☐ There's a law that empowers the CBO to collect *and* spend funds for O&M of boreholes.

	Administrative issues
	☐ There's no unit or person in the Local Government to support the CBO towards implementation and O&M of the borehole.
	☐ There is a unit or person in the Local Government to support the CBO towards implementation and O&M of the borehole, but nobody is directly responsible for it.
	☐ There is a unit or person in the Local Government to support the CBO towards implementation and O&M of the borehole, and there's a direct responsible for it.
	☐ The CBO is not politically represented in the Local Government.
	☐ The CBO is informally invited to Local Government meetings.
	☐ The CBO is formally represented in the Local Government council or substructures.
	☐ The Local Government ignores the CBO in decision-making processes related to boreholes.
	☐ The Local Government informs the CBO about decision-making processes related to boreholes but makes them not a part of these.
	☐ The Local Government involves the CBO in decision-making processes related to boreholes.
	☐ There is no knowledge on procedures for O&M of boreholes.
	☐ There's knowledge in LG on procedures for O&M of boreholes but it does not reach the CBO.
	☐ There's knowledge on procedures for O&M of boreholes available to the CBO by booklets, training workshops, etc.
	Planning issues
	☐ The Local Government did not include the borehole project in its plans for provision of water.
	☐ The Local Government did not include the borehole project in its plans for provision of water but was informed about its implementation.
	☐ The Local Government included the borehole project in its plans for water provision right from the very beginning of the borehole project.
	☐ There is no planning for O&M of boreholes.
	☐ There is planning for O&M of boreholes but the CBO doesn't take part in the process of planning.
	☐ There is planning for O&M of boreholes and the CBO takes part in the process of planning.
	☐ There is no contact between Local Government and *CREDO*.
	☐ There is contact with *CREDO* and the Local Government adjusts to its requirements
	☐ There is contact with *CREDO* and they adjust to the Local Government's requirements

Important note

This instrument was elaborated based on two documents:

1. Helmsing, A.H.J. Bert (2001) Decentralization, enablement and local governance in low income countries. Working paper series No 342. Institute of social Studies, The Hague, NL.

2. Reed, P. H. B. (2004). Rural Water Supply in Africa. Building Blocks for Hand pump Sustainability: Water, Engineering and Development Centre Loughborough University. Water, Leicestershire, U.K.

Annex III: Calculation of averages

Calculation of total average for each project

The answers given by the survey's respondents to sub issues of specific aspects were assigned 1, 2 or 3 points, which were averaged to obtain a total score for each issue and for each project. The following examples show the calculation of the total score for one of the projects surveyed and the calculation of specific issues' averages:

Project: Kpuri.	Year of implementation: 2005	
Overall score:		**2.58**
Specific issue: Project process	**Average:**	**2.50**
Sub issue	score	
participation	1 The pump was 'given', community not offered chance to participate. 2 Community was asked if they wanted to participate. (3) The community initiated the project themselves.	3.00
capital contribution	1 Community did not make any financial or in-kind contribution towards pump. (2) Community made significant in-kind contribution (set by the Project). 3 Community made financial contribution (set by the Project).	2.00
Specific issue: Institutional arrangements	**Average:**	**3.00**
Sub issue	score	
management system	1 No community organization has responsibility for the water source. 2 Community has organization but is not managing the source satisfactorily. (3) Community organization is actively managing the source to everyone's satisfaction.	3.00
training	1 No one in community received any training from the Project or government staff. 2 Some people trained but cannot remember or apply what was learned. (3) Useful training was provided which still benefits trainees now.	3.00
major breakdowns	1 Community would not know what to do in event of major breakdown. 2 No clear procedure, responsibilities unclear in case of major breakdown. (3) Clear procedure - confident that pump would be quickly repaired in case of major breakdown.	3.00
Specific issue: Water supply issues	**Average:**	**3.00**
Sub issue	score	
water use	1 Water never used for drinking. 2 Water sometimes used for drinking water, sometimes not. (3) Water always used for drinking water.	3.00
water quality	1 All the people who use the pump perceive the water is not good for drinking. 2 Some of the people who use the pump perceive the water is not good for drinking. (3) Everyone who uses the pump perceives the water is good for drinking.	3.00
source reliability	1 The water source yield is poor, people have to use other sources all the time. 2 Sometimes (dry season) the yield is inadequate to meet everyone's needs. (3) The water source always meets everyone's needs.	3.00
Specific issue: Maintenance	**Average:**	**3.00**
Sub issue	score	
tech skills	1 Technical skills not available to community for maintenance when needed. 2 Some technical skills available for maintenance and repairs, but not all. (3) Technical skills for all maintenance processes and repairs readily available.	3.00
equip & spares	1 Maintenance equipment and spare parts not available. 2 Some availability but not for all repairs. (3) Equipment and spares available for all repairs.	3.00
prev maintenance	1 No preventive maintenance being carried out on pump. 2 Some preventive maintenance being carried out, but not regularly. (3) Regular programme of preventive maintenance carried out.	3.00
maintenance funds	1 No funds readily available for maintenance when needed. 2 Some funds readily available but not sufficient for most expensive repairs. (3) Funds readily available and sufficient to cover most expensive repairs.	3.00

Specific issue:Community		Average:	2.33
Sub issue	score		
access /exclusion	1 Some people never get access to the pump when they want to use it. 2 Some people sometimes do not get access to the pump. 3 All the people who want to use the pump can gain access all the time.		3.00
impct	1 There is no improvement in the community quality of life after the hand pump 2 There is some improvement but not sufficient to solve all water problems 3 Quality of life of the community has substantially improved.		2.00
user satisfaction	1 Community does not like the hand pump and would prefer other water sources. 2 Like the hand pump but worried about sustainability. 3 Happy with the hand pump and expect to be able to sustain it.		3.00
hygien awarene ss	1 No one in the community is aware of the link between dirty water and diseases. 2 People are generally aware of need to use water in a hygienic way but often ignore it. 3 All the people are aware and use water in a hygienic way.		2.00
tech choice	1 The Community wasn't informed about the type of pump to be implemented. 2 The Community was informed and asked their opinion about the type of pump to be 3 The Community chose the type of pump they wanted to be implemented.		1.00
ownership over O&M	1 The Community doesn't understand how to operate the pump. 2 The Community understands how to operate the pump but doesn't know how to do repairs. 3 The Community understands how to operate the pump and knows how to do repairs.		3.00
Specific issue:. Enabling Local Government		**Average:**	**1.64**
Sub issue	score		
a) Legal issues			**1.67**
legal recogn ition of CBO's	1 The CBO is not registered in the Local Government. 2 The CBO is registered in the Local Government but doesn't have legal power to sign 3 The CBO is registered in the Local Government and has legal power to sign contracts		1.00
budget provisi ons	1 The Local Government has no budget to support O&M of boreholes. 2 The Local Government has sometimes a budget for O&M of boreholes. 3 The Local Government has always a budget to support O&M of boreholes		1.00
co manageme nt of funds	1 There's no law that empowers the CBO to collect funds for O&M of boreholes. 2 There's a law that empowers the CBO to collect funds for O&M of boreholes on behalf of LG. 3 There's a law that empowers the CBO to collect *and* spend funds for O&M of boreholes.		3.00
b) Actual enablement			**2.25**
Administrativ e mechanisms	1 There's no unit or person in the Local Government to support the CBO towards implementation and O&M of the borehole. 2 There is a unit or person in the Local Government to support the CBO towards implementation and O&M of the borehole, but nobody is directly responsible for it. 3 There is a unit or person in the Local Government to support the CBO towards implementation and O&M of the borehole, and there's a direct responsible for it.		3.00
Political represen tation of CBO's	1 The CBO is not politically represented in the Local Government. 2 The CBO is informally invited to Local Government meetings. 3 The CBO is formally represented in the Local Government council or substructures.		1.00
Political weight of CBO's	1 The Local Government ignores the CBO in decision-making processes related to boreholes. 2 The Local Government informs the CBO about decision-making processes related to boreholes but makes them not a part of these. 3 The Local Government involves the CBO in decision-making processes related to boreholes.		3.00
Stimulation for O&M	1 There is no knowledge on procedures for O&M of boreholes. 2 There's knowledge in LG on procedures for O&M of boreholes but it does not reach the CBO. 3 There's knowledge on procedures for O&M of boreholes available to the CBO by booklets, training workshops, etc.		2.00
c) Planning issues			**1.00**
Place of planning for boreholes in LG planning	1 The Local Government did not include the borehole project in its plans for provision of water. 2 The Local Government did not include the borehole project in its plans for provision of water but was informed about its implementation. 3 The Local Government included the borehole project in its plans for water provision right from the very beginning of the borehole project.		1.00
Planning and importance for O&M of	1 There is no planning for O&M of boreholes. 2 There is planning for O&M of boreholes but the CBO doesn't take part in the process of planning. 3 There is planning for O&M of boreholes and the CBO takes part in the process of planning.		1.00
Convergen ce	1 There is no contact between Local Government and *CREDO* . 2 There is contact with *CREDO* and the Local Government adjusts to its requirements 3 There is contact with *CREDO* and they adjust to the Local Government's requirements		1.00

Project process sub issues of participation and capital contribution were averaged, obtaining an average for this specific issue:

(participation score + capital contribution score)= Project process average
2

(3+2) = 2.50
2

The same operation was done to find averages for each of the subsequent specific issues.

Finally, specific issues average's scores were averaged to obtain the overall score for the project:

(Project process avr.+Inst. Arrangements avr.+Water supply issues avr.
+Maintenance avr.+Community avr.+Enabling Gov. avr.) = Overall score
6

(2.50+3.0+3.0+3.0+2.33+1.64) = 2.58
6

The same operation was done to obtain overall scores for all projects.

All are unweighted averages.

Calculation of total averages for specific aspects

For each of the 20 projects, averages of specific aspects were calculated as explained above. The scores obtained were again averaged to obtain total averages for each specific issue. This example illustrates the calculation:

(Sia's project process avr. + Nanodon's project
process avr. +…+Kouri's project process avr.) = Total project process Average
20

The same operation was done for each of the specific aspects

	Averages per project				
	Sia	Nanodon	…	Kouri	
Project process	2.00	2.50	…	2.50	2.40
Institutional arrangements	2.00	2.33	…	3.00	2.50
Water supply issues	3.00	2.33	…	3.00	2.93
Maintenance	2.00	2.25	…	3.00	2.41
Community	2.17	2.00	…	2.33	2.32
Enabling government	1.64	1.64	…	1.64	1.64

Annex IV: Information gathered from surveys

Generic aspects — **GROUP A**

General questions		2. Lon 98	9. Sapouy quartier Nalia 97	11. Kouri 05	12. Sati 05	14. Ly 02	17. Beneverou 02	18. Kayero-Bo (Gogobie) 05
a)	**Is the MCC still in existence and/or operational?**	yes: x	yes: x	yes: x	yes: x	yes: x	yes: x	yes: x
	If yes, how many members?	7	6	5	6	6	10	6
	How many are women?	2	0	1	0	0	3	0
b)	**Who is responsible for O&M of the borehole?**	MCC: x	MCC: x	MCC: x	MCC: x	MCC: x	MCC: x	MCC: x
	Where is (s)he/it from?	C: x	C: x	C: x	C: x	C: x	C: x	C: x
	How many members?	7	6	5	6	6	10	6
	How many are women?	2	0	1	0	0	3	0
c)	**Who owns the borehole?**	C: x	C: x	C: x	C: x	C: x	C: x	C: x
	Where is (s)he/it from?	C: x	C: x	C: x	C: x	C: x	C: x	C: x
d)	**Who owns the plot where the borehole is built?**	C: x	C: x	P: x	P: x	O: x	P: x	P: x
	Where is (s)he/it from?	C: x	C: x	C: x	C: x	C: x	C: x	C: x
e)	**Has the borehole been in continuous operation ?**	no: x	yes: x	yes: x	no: x	yes: x	yes: x	no: x
	If not, for how long?	aprox. 1 month			more than 10 days			2 days
f)	**Who does the Repairs and provides spare parts?**	P: x	P: x	P: x P: x	P: x P: x	P: x P: x	P: x	P: x
	Where is (s)he/it from?	NGO: x	C: x NGO: x	C: x NGO: x	C: x NGO: x	C: x NGO: x	NGO: x	C: x NGO: x
g)	**Where does the money for Repairs and spare parts come from?**	MCC: x	MCC: x C: x	C: x	MCC: x C: x	MCC: x C: x	MCC: x	MCC: x C: x
	Where is (s)he/it from?	C: x	C: x	C: x	C: x	C: x	C: x	C: x
h)	**Would the Community be willing to pay for O&M ?**	yes: x	yes: x	yes: x	yes: x	yes: x	yes: x	yes: x

Notes

f. Repairs done by a health center worker based in Kayero,comisioned by CREDO, who also provides spare parts

F. Two mechanics formed by CREDO based on the village have assured all repairements of all pumps in the area

g. Money for repairs and spare parts is paid by selling water

f. Repairs done by mechanics formed by CREDO, spares provided by a private person

f. Repairs done by mechanics formed by CREDO, spares provided by a private person

f. Spares and repairs provided by a private person and by the village mechanics

F. The formed mechanics don't have tools box

f. Repairs done by a health center worker based in Kayero,comisioned by CREDO, who also provides spare parts. Until 06 village mechanics were trained. Spares provided by the private sector

Generic aspects — **GROUP B**

General questions			1. Meteo 97	3. Bagoun 04	4. Bieha 99	10. Nadion 02	13. Kankuyo 05	19. Lan 00
a)	**Is the MCC still in existence and/or operational?**	yes	x	x		x	x	x
		no			x			
	If yes, how many members?		7	6		6	6	8
	How many are women?		2	2		0	1	2
b)	**Who is responsible for O&M of the borehole?**	MCC	x	x		x	x	x
		P			x			
		O		x				
	Where is (s)he/it from?	C	x	x	x	x	x	x
		NGO						
		LG						
		PS						
	How many members?		7	6	1	6	6	8
	How many are women?		2	2	0	0	1	2
c)	**Who owns the borehole?**	MCC						
		P						
		O		x	x			
		C	x			x	x	x
	Where is (s)he/it from?	C	x	x	x	x	x	x
		NGO						
		LG						
		PS						
d)	**Who owns the plot where the borehole is built?**	MCC						
		P	x			x	x	
		O		x	x			
		C						x
	Where is (s)he/it from?	C	x		x	x	x	x
		NGO						
		LG						
		PS						
e)	**Has the borehole been in continuous operation ?**	yes	x			x	x	
		no		x	x			x
	If not, for how long?			2 weeks	broken since 4 months			3 days
f)	**Who does the Repairs and provides spare parts?**	MCC						
		P	x	x	x	x	x	x
		O						
		C						
	Where is (s)he/it from?	C						
		NGO	x	x	x	x	x	x
		LG						
		PS	x					x
g)	**Where does the money for Repairs and spare parts come**	MCC	x	x		x	x	x
		P			x			
		O			x			
		C						
	Where is (s)he/it from?	C	x	x	x	x	x	x
		NGO						
		LG						
		PS						
h)	**Would the Community be willing to pay for O&M ?**	yes	x	x	x	x	x	x
		no						

Notes

f. Repairments done by a health center worker based in Kayero, from CREDO, or by the repair craftsman based in To. Spare parts provided by the people involved

f. Repairments done by a private person & mechanics from another borehole in the same village

f. The church pastor (formed as a mechanic and a private person)

g. The church pastor and the local church organisation

f. Spares and repairmets provided by a private person

Generic aspects — **GROUP C**

General questions		5. Tone 03	6. Kabourou 04	7. Sia 04	8. Nadonoh 00	15. Gao 00	16. To Quartier Kindy 03	20. Sanga 05
a)	**Is the MCC still in existence and/or operational?**	yes: x / no	yes: x / no	yes / no: x	yes: x / no	yes: x / no	yes: x / no	yes: X / no
	If yes, how many members?	5	4		9	6	5	5
	How many are women?	0	2		2	1	2	2
b)	**Who is responsible for O&M of the borehole?**	MCC: x / P / O	MCC: x / P / O	MCC / P / O: Nobody	MCC: x / P / O	MCC: x / P / O	MCC: x / P / O	MCC: X / P / O
	Where is (s)he/it from?	C: x / NGO / LG / PS	C: x / NGO / LG / PS	C / NGO / LG / PS	C: x / NGO / LG / PS	C: x / NGO / LG / PS	C: x / NGO / LG / PS	C: X / NGO / LG / PS
	How many members?	5	4		9	6	5	5
	How many are women?	0	2		2	1	2	2
c)	**Who owns the borehole?**	MCC / P / O: x / C	MCC / P / O: x / C	MCC / P / O: x / C	MCC / P / O / C: x	MCC / P / O: x / C	MCC / P / O / C: x	MCC / P / O / C: x
	Where is (s)he/it from?	C: x / NGO / LG / PS	C: x / NGO / LG / PS	C: x / NGO / LG / PS	C: x / NGO / LG / PS	C: x / NGO / LG / PS	C: x / NGO / LG / PS	C: X / NGO / LG / PS
d)	**Who owns the plot where the borehole is built?**	MCC / P / O: x / C	MCC / P / O: x / C	MCC / P / O: x / C	MCC / P / O: x / C	MCC / P / O: x / C	MCC / P / O / C: x	MCC / P / O / C: x
	Where is (s)he/it from?	C: x / NGO / LG / PS	C: x / NGO / LG / PS	C: x / NGO / LG / PS	C: x / NGO / LG / PS	C: x / NGO / LG / PS	C: x / NGO / LG / PS	C: x / NGO / LG / PS
e)	**Has the borehole been in continuous operation ?**	yes: x / no	yes / no: x	yes / no: x	yes / no: x	yes / no: x	yes: x / no	yes / no: x
	If not, for how long?		3 days	broken since 6 months	since 4 years	aprox 4 days		out of order for 10 days now
f)	**Who does the Repairs and provides spare parts?**	MCC / P: x / O / C	MCC / P: x / O / C	MCC / P: x / O / C	MCC / P: x / O / C	MCC / P: x / O / C	MCC / P: x / O / C	MCC / P: x / O / C
	Where is (s)he/it from?	C / NGO / LG / PS: x	C / NGO / LG / PS: x	C / NGO / LG / PS: x	C: x / NGO / LG / PS	C / NGO / LG: x / PS	C / NGO / LG / PS: x	C: x / NGO / LG / PS: x
g)	**Where does the money for Repairs and spare parts come**	MCC / P / O: x / C	MCC: x / P / O / C	MCC / P / O: x / C	MCC: x / P / O / C	MCC: x / P / O / C	MCC: x / P / O / C	MCC: x / P / O / C
	Where is (s)he/it from?	C: x / NGO / LG / PS	C: x / NGO / LG / PS	C: x / NGO / LG / PS	C: x / NGO / LG / PS	C: x / NGO / LG / PS	C: x / NGO / LG / PS	C: x / NGO / LG / PS
h)	**Would the Community be willing to pay for O&M ?**	yes: x / no	yes: x / no	yes: x / no	yes: x / no	yes: x / no	yes / no	yes: x / no
Notes		f. Repairments done by a repair craftsman in Fara (90km), formed by former projects g. Selling water and the church funds support reparaiements expenses	f. Repairments done by a repair craftsman in Environ (15 km), formed by former projects g. The water is sold	f. Repairmentsand spare parts done by a repair craftsman (20 km) g. Church funds and a person who sometimes funds the church for repairements	f. A mechanic formed by CREDO used to carry on repairments before the borehole broke, he didn't earn money for the repairments	f. Spares and repairmets provided by a private person	f. Repairements done by a repair craftsman formed for previous projects and spares provided by the private sector	f. Repairements done by formed mechanics and spares provided by a person from the private sector

Group			GROUP A							
Projects			Kpuri 05	Sapouy 97	Benavered	Kayero-Bo	Sati 05	Ly 02	Lon 98	A
Specific aspects: overall score			*2.58*	*2.57*	*2.52*	*2.51*	*2.50*	*2.48*	*2.47*	
Section II. Project process			**2.50**	**2.50**	**2.50**	**2.50**	**2.50**	**2.50**	**2.50**	**2.50**
1	*participation*	The pump was 'given', community not offered chance to participate.	3.00	3.00	3.00	3.00	3.00	3.00	3.00	**3.00**
2		Community was asked if they wanted to participate.								
3		The community initiated the project themselves.								
1	*capital contribution*	Community did not make any financial or in-kind contribution towards pump.	2.00	2.00	2.00	2.00	2.00	2.00	2.00	**2.00**
2		Community made significant in-kind contribution (set by the Project).								
3		Community made financial contribution (set by the Project).								
Section III. Institutional arrangements			**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**2.67**	**2.67**	**2.90**
1	*management system*	No community organization has responsibility for the water source.	3.00	3.00	3.00	3.00	3.00	2.00	2.00	**2.71**
2		Community has organization but is not managing the source satisfactorily.								
3		Community organization is actively managing the source to everyone's satisfaction.								
1	*training*	No one in community received any training from the Project or government staff.	3.00	3.00	3.00	3.00	3.00	3.00	3.00	**3.00**
2		Some people trained but cannot remember or apply what was learned.								
3		Useful training was provided which still benefits trainees now.								
1	*major breakdowns*	Community would not know what to do in event of major breakdown.	3.00	3.00	3.00	3.00	3.00	3.00	3.00	**3.00**
2		No clear procedure, responsibilities unclear in case of major breakdown.								
3		Clear procedure - confident that pump would be quickly repaired in case of major breakdown.								
Section IV. Water supply issues			**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**
1	*water use*	Water never used for drinking.	3.00	3.00	3.00	3.00	3.00	3.00	3.00	**3.00**
2		Water sometimes used for drinking water, sometimes not.								
3		Water always used for drinking water.								
1	*wate rquality*	All the people who use the pump perceive the water is not good for drinking.	3.00	3.00	3.00	3.00	3.00	3.00	3.00	**3.00**
2		Some of the people who use the pump perceive the water is not good for drinking.								
3		Everyone who uses the pump perceives the water is good for drinking.								
1	*source reliability*	The water source yield is poor, people have to use other sources all the time.	3.00	3.00	3.00	3.00	3.00	3.00	3.00	**3.00**
2		Sometimes (dry season) the yield is inadequate to meet everyone's needs.								
3		The water source always meets everyone's needs.								
Section V. Maintenance			**3.00**	**2.75**	**2.50**	**2.75**	**2.50**	**2.75**	**2.50**	**2.68**
1	*tech skills*	Technical skills not available to community for maintenance when needed.	3.00	3.00	3.00	3.00	3.00	3.00	3.00	**3.00**
2		Some technical skills available for maintenance and repairs, but not all.								
3		Technical skills for all maintenance processes and repairs readily available.								
1	*equip & spares*	Maintenance equipment and spare parts not available.	3.00	3.00	3.00	3.00	3.00	3.00	3.00	**3.00**
2		Some availability but not for all repairs.								
3		Equipment and spares available for all repairs.								
1	*prev maintenance*	No preventive maintenance being carried out on pump.	3.00	3.00	2.00	2.00	1.00	3.00	3.00	**2.43**
2		Some preventive maintenance being carried out, but not regularly.								
3		Regular programme of preventive maintenance carried out.								
1	*maintenance funds*	No funds readily available for maintenance when needed.	3.00	2.00	2.00	3.00	3.00	2.00	1.00	**2.29**
2		Some funds readily available but not sufficient for most expensive repairs.								
3		Funds readily available and sufficient to cover most expensive repairs.								
Section VI. Community			**2.33**	**2.50**	**2.50**	**2.17**	**2.33**	**2.33**	**2.50**	**2.38**
1	*access/exclusion*	Some people never get access to the pump when they want to use it.	3.00	3.00	3.00	3.00	3.00	3.00	3.00	**3.00**
2		Some people sometimes do not get access to the pump.								
3		All the people who want to use the pump can gain access all the time.								
1	*impct*	There is no improvement in the community quality of life after the hand pump installation.	2.00	3.00	3.00	3.00	2.00	2.00	3.00	**2.57**
2		There is some improvement but not sufficient to solve all water problems								
3		Quality of life of the community has substantially improved.								
1	*user satisfaction*	Community does not like the hand pump and would prefer other water sources.	3.00	3.00	3.00	3.00	3.00	3.00	3.00	**3.00**
2		Like the hand pump but worried about sustainability.								
3		Happy with the hand pump and expect to be able to sustain it.								
1	*hygien awareness*	No one in the community is aware of the link between dirty water and diseases.	2.00	2.00	2.00	0.00	2.00	2.00	2.00	**1.71**
2		People are generally aware of need to use water in a hygienic way but often ignore it.								
3		All the people are aware and use water in a hygienic way.								
1	*tech choice*	The Community wasn't informed about the type of pump to be implemented.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	**1.00**
2		The Community was informed and asked their opinion about the type of pump to be implemented.								
3		The Community chose the type of pump they wanted to be implemented.								
1	*ownership over O&M*	The Community doesn't understand how to operate the pump.	3.00	3.00	3.00	3.00	3.00	3.00	3.00	**3.00**
2		The Community understands how to operate the pump but doesn't know how to do repairs.								
3		The Community understands how to operate the pump and knows how to do repairs.								

		Group	GROUP B						
		Projects	Lan 00	Nadion 02	Knakuyo 0	Meteo 97	Bagoun 04	Bieha 99	B
		Specific aspects: overall score	*2.43*	*2.38*	*2.36*	*2.34*	*2.33*	*2.37*	
Section II. Project process			**2.50**	**2.50**	**2.50**	**2.50**	**2.50**	**2.00**	2.42
1	participation	The pump was 'given', community not offered chance to participate.	3.00	3.00	3.00	3.00	3.00	3.00	**3.00**
2		Community was asked if they wanted to participate.							
3		The community initiated the project themselves.							
1	capital contribution	Community did not make any financial or in-kind contribution towards pump.	2.00	2.00	2.00	2.00	2.00	1.00	**1.83**
2		Community made significant in-kind contribution (set by the Project).							
3		Community made financial contribution (set by the Project).							
Section III. Institutional arrangements			**2.67**	**2.33**	**2.67**	**2.33**	**2.33**	**2.67**	**2.50**
1	management system	No community organization has responsibility for the water source.	2.00	2.00	3.00	2.00	2.00	2.00	**2.17**
2		Community has organization but is not managing the source satisfactorily.							
3		Community organization is actively managing the source to everyone's satisfaction.							
1	training	No one in community received any training from the Project or government staff.	3.00	2.00	2.00	2.00	2.00	3.00	**2.33**
2		Some people trained but cannot remember or apply what was learned.							
3		Useful training was provided which still benefits trainees now.							
1	major breakdowns	Community would not know what to do in event of major breakdown.	3.00	3.00	3.00	3.00	3.00	3.00	**3.00**
2		No clear procedure, responsibilities unclear in case of major breakdown.							
3		Clear procedure - confident that pump would be quickly repaired in case of major breakdown.							
Section IV. Water supply issues			**3.00**	**3.00**	**2.33**	**3.00**	**3.00**	**3.00**	2.89
1	water use	Water never used for drinking.	3.00	3.00	2.00	3.00	3.00	3.00	**2.83**
2		Water sometimes used for drinking water, sometimes not.							
3		Water always used for drinking water.							
1	wate rquality	All the people who use the pump perceive the water is not good for drinking.	3.00	3.00	2.00	3.00	3.00	3.00	**2.83**
2		Some of the people who use the pump perceive the water is not good for drinking.							
3		Everyone who uses the pump perceives the water is good for drinking.							
1	source reliability	The water source yield is poor, people have to use other sources all the time.	3.00	3.00	3.00	3.00	3.00	3.00	**3.00**
2		Sometimes (dry season) the yield is inadequate to meet everyone's needs.							
3		The water source always meets everyone's needs.							
Section V. Maintenance			**2.25**	**2.50**	**3.00**	**2.25**	**2.00**	**2.50**	2.42
1	tech skills	Technical skills not available to community for maintenance when needed.	3.00	3.00	3.00	3.00	3.00	3.00	**3.00**
2		Some technical skills available for maintenance and repairs, but not all.							
3		Technical skills for all maintenance processes and repairs readily available.							
1	equip & spares	Maintenance equipment and spare parts not available.	3.00	3.00	3.00	3.00	3.00	3.00	**3.00**
2		Some availability but not for all repairs.							
3		Equipment and spares available for all repairs.							
1	prev maintenance	No preventive maintenance being carried out on pump.	2.00	3.00	3.00	1.00	1.00	3.00	**2.17**
2		Some preventive maintenance being carried out, but not regularly.							
3		Regular programme of preventive maintenance carried out.							
1	maintenance funds	No funds readily available for maintenance when needed.	1.00	1.00	3.00	2.00	1.00	1.00	**1.50**
2		Some funds readily available but not sufficient for most expensive repairs.							
3		Funds readily available and sufficient to cover most expensive repairs.							
Section VI. Community			**2.50**	**2.33**	**2.00**	**2.33**	**2.50**	**2.40**	2.34
1	access/exclusion	Some people never get access to the pump when they want to use it.	3.00	3.00	3.00	3.00	3.00	3.00	**3.00**
2		Some people sometimes do not get access to the pump.							
3		All the people who want to use the pump can gain access all the time.							
1	impct	There is no improvement in the community quality of life after the hand pump installation.	3.00	2.00	2.00	3.00	3.00	3.00	**2.67**
2		There is some improvement but not sufficient to solve all water problems							
3		Quality of life of the community has substantially improved.							
1	user satisfaction	Community does not like the hand pump and would prefer other water sources.	3.00	3.00	3.00	3.00	3.00	0.00	**3.00**
2		Like the hand pump but worried about sustainability.							
3		Happy with the hand pump and expect to be able to sustain it.							
1	hygien awareness	No one in the community is aware of the link between dirty water and diseases.	2.00	2.00	0.00	2.00	2.00	2.00	**1.67**
2		People are generally aware of need to use water in a hygienic way but often ignore it.							
3		All the people are aware and use water in a hygienic way.							
1	tech choice	The Community wasn't informed about the type of pump to be implemented.	1.00	1.00	1.00	1.00	1.00	1.00	**1.00**
2		The Community was informed and asked their opinion about the type of pump to be implemented.							
3		The Community chose the type of pump they wanted to be implemented.							
1	ownership over O&M	The Community doesn't understand how to operate the pump.	3.00	3.00	3.00	2.00	3.00	3.00	**2.83**
2		The Community understands how to operate the pump but doesn't know how to do repairs.							
3		The Community understands how to operate the pump and knows how to do repairs.							

Group			B	GROUP C							C
Projects				To(Kindy)	Kabouro 0	Gao 00	Sanga	Ton'e 03	Sia 04	Nadonon	
Specific aspects: overall score				*2.27*	*2.26*	*2.25*	*2.22*	*2.22*	*2.13*	*2.18*	
Section II. Project process			2.42	2.50	2.00	2.50	2.50	2.00	2.00	2.50	2.29
1	participation	The pump was 'given', community not offered chance to participate.	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
2		Community was asked if they wanted to participate.									
3		The community initiated the project themselves.									
1	capital contribution	Community did not make any financial or in-kind contribution towards pump.	1.83	2.00	1.00	2.00	2.00	1.00	1.00	2.00	1.57
2		Community made significant in-kind contribution (set by the Project).									
3		Community made financial contribution (set by the Project).									
Section III. Institutional arrangements			2.50	2.00	2.33	2.00	1.67	2.33	2.00	2.33	2.10
1	management system	No community organization has responsibility for the water source.	2.17	2.00	2.00	2.00	2.00	2.00	1.00	2.00	1.86
2		Community has organization but is not managing the source satisfactorily.									
3		Community organization is actively managing the source to everyone's satisfaction.									
1	training	No one in community received any training from the Project or government staff.	2.33	1.00	2.00	1.00	3.00	2.00	2.00	2.00	1.86
2		Some people trained but cannot remember or apply what was learned.									
3		Useful training was provided which still benefits trainees now.									
1	major breakdowns	Community would not know what to do in event of major breakdown.	3.00	3.00	3.00	3.00	0.00	3.00	3.00	3.00	2.57
2		No clear procedure, responsibilities unclear in case of major breakdown.									
3		Clear procedure - confident that pump would be quickly repaired in case of major breakdown.									
Section IV. Water supply issues			2.89	3.00	3.00	3.00	3.00	3.00	3.00	2.33	2.90
1	water use	Water never used for drinking.	2.83	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
2		Water sometimes used for drinking water, sometimes not.									
3		Water always used for drinking water.									
1	wate rquality	All the people who use the pump perceive the water is not good for drinking.	2.83	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
2		Some of the people who use the pump perceive the water is not good for drinking.									
3		Everyone who uses the pump perceives the water is good for drinking.									
1	source reliability	The water source yield is poor, people have to use other sources all the time.	3.00	3.00	3.00	3.00	3.00	3.00	3.00	1.00	2.71
2		Sometimes (dry season) the yield is inadequate to meet everyone's needs.									
3		The water source always meets everyone's needs.									
Section V. Maintenance			2.42	2.00	2.25	2.00	2.50	2.00	2.00	2.25	2.14
1	tech skills	Technical skills not available to community for maintenance when needed.	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
2		Some technical skills available for maintenance and repairs, but not all.									
3		Technical skills for all maintenance processes and repairs readily available.									
1	equip & spares	Maintenance equipment and spare parts not available.	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
2		Some availability but not for all repairs.									
3		Equipment and spares available for all repairs.									
1	prev maintenance	No preventive maintenance being carried out on pump.	2.17	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
2		Some preventive maintenance being carried out, but not regularly.									
3		Regular programme of preventive maintenance carried out.									
1	maintenance funds	No funds readily available for maintenance when needed.	1.50	1.00	2.00	1.00	3.00	1.00	1.00	2.00	1.57
2		Some funds readily available but not sufficient for most expensive repairs.									
3		Funds readily available and sufficient to cover most expensive repairs.									
Section VI. Community			2.34	2.50	2.33	2.33	2.00	2.33	2.17	2.00	2.24
1	access/exclusion	Some people never get access to the pump when they want to use it.	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
2		Some people sometimes do not get access to the pump.									
3		All the people who want to use the pump can gain access all the time.									
1	impct	There is no improvement in the community quality of life after the hand pump installation.	2.67	3.00	3.00	3.00	2.00	3.00	3.00	2.00	2.71
2		There is some improvement but not sufficient to solve all water problems									
3		Quality of life of the community has substantially improved.									
1	user satisfaction	Community does not like the hand pump and would prefer other water sources.	3.00	3.00	3.00	3.00	3.00	3.00	2.00	2.00	2.71
2		Like the hand pump but worried about sustainability.									
3		Happy with the hand pump and expect to be able to sustain it.									
1	hygien awareness	No one in the community is aware of the link between dirty water and diseases.	1.67	2.00	2.00	2.00	0.00	2.00	2.00	0.00	2.00
2		People are generally aware of need to use water in a hygienic way but often ignore it.									
3		All the people are aware and use water in a hygienic way.									
1	tech choice	The Community wasn't informed about the type of pump to be implemented.	1.00	2.00	1.00	1.00	1.00	1.00	1.00	1.00	1.14
2		The Community was informed and asked their opinion about the type of pump to be implemented.									
3		The Community chose the type of pump they wanted to be implemented.									
1	ownership over O&M	The Community doesn't understand how to operate the pump.	2.83	2.00	2.00	2.00	3.00	2.00	2.00	2.00	2.14
2		The Community understands how to operate the pump but doesn't know how to do repairs.									
3		The Community understands how to operate the pump and knows how to do repairs.									

		Specific aspects: average scores per group	A	B	C	Total avr.
Section II. Project process			**2.50**	**2.42**	**2.29**	**2.40**
1	participation	The pump was 'given', community not offered chance to participate.				
2		Community was asked if they wanted to participate.	**3.00**	**3.00**	**3.00**	
3		The community initiated the project themselves.				3.00
1	capital contribution	Community did not make any financial or in-kind contribution towards pump.				
2		Community made significant in-kind contribution (set by the Project).	**2.00**	**1.83**	**1.57**	
3		Community made financial contribution (set by the Project).				1.80
Section III. Institutional arrangements			**2.90**	**2.50**	**2.10**	**2.50**
1	management system	No community organization has responsibility for the water source.				
2		Community has organization but is not managing the source satisfactorily.	**2.71**	**2.17**	**1.86**	
3		Community organization is actively managing the source to everyone's satisfaction.				2.25
1	training	No one in community received any training from the Project or government staff.				
2		Some people trained but cannot remember or apply what was learned.	**3.00**	**2.33**	**1.86**	
3		Useful training was provided which still benefits trainees now.				2.40
1	major breakdowns	Community would not know what to do in event of major breakdown.				
2		No clear procedure, responsibilities unclear in case of major breakdown.	**3.00**	**3.00**	**2.57**	
3		Clear procedure - confident that pump would be quickly repaired in case of major breakdown.				2.86
Section IV. Water supply issues			**3.00**	**2.89**	**2.90**	**2.93**
1	water use	Water never used for drinking.				
2		Water sometimes used for drinking water, sometimes not.	**3.00**	**2.83**	**3.00**	
3		Water always used for drinking water.				2.94
1	wate rquality	All the people who use the pump perceive the water is not good for drinking.				
2		Some of the people who use the pump perceive the water is not good for drinking.	**3.00**	**2.83**	**3.00**	
3		Everyone who uses the pump perceives the water is good for drinking.				2.94
1	source reliability	The water source yield is poor, people have to use other sources all the time.				
2		Sometimes (dry season) the yield is inadequate to meet everyone's needs.	**3.00**	**3.00**	**2.71**	
3		The water source always meets everyone's needs.				2.90
Section V. Maintenance			**2.68**	**2.42**	**2.14**	**2.41**
1	tech skills	Technical skills not available to community for maintenance when needed.				
2		Some technical skills available for maintenance and repairs, but not all.	**3.00**	**3.00**	**3.00**	
3		Technical skills for all maintenance processes and repairs readily available.				3.00
1	equip & spares	Maintenance equipment and spare parts not available.				
2		Some availability but not for all repairs.	**3.00**	**3.00**	**3.00**	
3		Equipment and spares available for all repairs.				3.00
1	prev maintenance	No preventive maintenance being carried out on pump.				
2		Some preventive maintenance being carried out, but not regularly.	**2.43**	**2.17**	**1.00**	
3		Regular programme of preventive maintenance carried out.				1.87
1	maintenance funds	No funds readily available for maintenance when needed.				
2		Some funds readily available but not sufficient for most expensive repairs.	**2.29**	**1.50**	**1.57**	
3		Funds readily available and sufficient to cover most expensive repairs.				1.79
Section VI. Community			**2.38**	**2.34**	**2.24**	**2.32**
1	access/exclusion	Some people never get access to the pump when they want to use it.				
2		Some people sometimes do not get access to the pump.	**3.00**	**3.00**	**3.00**	
3		All the people who want to use the pump can gain access all the time.				3.00
1	impct	There is no improvement in the community quality of life after the hand pump installation.				
2		There is some improvement but not sufficient to solve all water problems	**2.57**	**2.67**	**2.71**	
3		Quality of life of the community has substantially improved.				2.65
1	user satisfaction	Community does not like the hand pump and would prefer other water sources.				
2		Like the hand pump but worried about sustainability.	**3.00**	**3.00**	**2.71**	
3		Happy with the hand pump and expect to be able to sustain it.				2.90
1	hygien awareness	No one in the community is aware of the link between dirty water and diseases.				
2		People are generally aware of need to use water in a hygienic way but often ignore it.	**1.71**	**1.67**	**2.00**	
3		All the people are aware and use water in a hygienic way.				1.79
1	tech choice	The Community wasn't informed about the type of pump to be implemented.				
2		The Community was informed and asked their opinion about the type of pump to be implemented.	**1.00**	**1.00**	**1.14**	
3		The Community chose the type of pump they wanted to be implemented.				1.05
1	ownership over O&M	The Community doesn't understand how to operate the pump.				
2		The Community understands how to operate the pump but doesn't know how to do repairs.	**3.00**	**2.83**	**2.14**	
3		The Community understands how to operate the pump and knows how to do repairs.				2.66

Section VII. Enabling Local Government		1.64
a) Legal issues		**1.67**
	a.1) Legal Recognition of CBO's	1.00
	1. The CBO is not registered in the Local Government. 2. The CBO is registered in the Local Government but doesn't have legal power to sign contracts with private actors. 3. The CBO is registered in the Local Government and has legal power to sign contracts with private actors.	
	a.2) LG Budget provisions	1.00
	1. The Local Government has no budget to support O&M of boreholes. 2. The Local Government has sometimes a budget for O&M of boreholes. 3. The Local Government has always a budget to support O&M of boreholes	
	a.3) Co-management of funds	3.00
	1. There's no law that empowers the CBO to collect funds for O&M of boreholes. 2. There's a law that empowers the CBO to collect funds for O&M of boreholes on behalf of LG. 3. There's a law that empowers the CBO to collect *and* spend funds for O&M of boreholes.	
b) Actual enablement		**2.25**
	b.1) Administrative mechanisms	*3.00*
	1. There's no unit or person in the Local Government to support the CBO towards implementation and O&M of the borehole. 2. There is a unit or person in the Local Government to support the CBO towards implementation and O&M of the borehole, but nobody is directly responsible for it. 3. There is a unit or person in the Local Government to support the CBO towards implementation and O&M of the borehole, and there's a direct responsible for it.	
	b.2) Political representation of CBO's	1.00
	1. The CBO is not politically represented in the Local Government. 2. The CBO is informally invited to Local Government meetings. 3. The CBO is formally represented in the Local Government council or	
	b.3) Political weight of CBO's	3.00
	1. The Local Government ignores the CBO in decision-making processes related to boreholes. 2. The Local Government informs the CBO about decision-making processes related to boreholes but makes them not a part of these. 3. The Local Government involves the CBO in decision-making processes related	
	b.4) Stimulation for O&M	2.00
	1. There is no knowledge on procedures for O&M of boreholes. 2.There's knowledge in LG on procedures for O&M of boreholes but it does not reach the CBO. 3. There's knowledge on procedures for O&M of boreholes available to the CBO by booklets, training workshops, etc.	
c) Planning issues		**1.00**
	c.1) Place of planning for boreholes in LG planning	1.00
	1. The Local Government did not include the borehole project in its plans for provision of water. 2. The Local Government did not include the borehole project in its plans for provision of water but was informed about its implementation. 3. The Local Government included the borehole project in its plans for water provision right from the very beginning of the borehole project.	
	c.2) Planning and importance for O&M of boreholes	1.00
	1. There is no planning for O&M of boreholes. 2. There is planning for O&M of boreholes but the CBO doesn't take part in the process of planning. 3. There is planning for O&M of boreholes and the CBO takes part in the process	
	c.3) Convergence	1.00
	1. There is no contact between Local Government and *CREDO* . 2. There is contact with *CREDO* and the Local Government adjusts to its 3. There is contact with *CREDO* and they adjust to the Local Government's	

Annex V: Calculation of the rank correlation coefficient

This example illustrates how the rank correlation coefficient (Rs) was calculated to analyse relations among specific issues of O&M.

The formula used for Rd was:

$$Rs = 1 - 6\frac{\Sigma d^2}{n^3 - n}$$

Where d is the difference in rank of a pair of values, and n is the number of pairs

This formula was used to analyse each relation explained in chapter III among specific issues of O&M:

1		Comparing water supply issues to maintenance						
GROUP	Projects	Total sustainability average	Water supply issues	Rank	Maintenance	Rank	d	d squared
A	A. Kpuri 05	2.58	9.00	9.5	12.00	1.5	8	64
A	A. Sapouy 97	2.57	9	9.5	11.00	4	5.5	30.25
A	A. Benavereou 02	2.52	9	9.5	10.00	8	1.5	2.25
A	A. Kayero-Bo (Gogobié) 05	2.51	9	9.5	11.00	4	5.5	30.25
A	A. Sati 05	2.5	9	9.5	10.00	8	1.5	2.25
A	A. Ly 02	2.48	9	9.5	11.00	4	5.5	30.25
A	A. Lon 98	2.47	9	9.5	10.00	8	1.5	2.25
B	B. Lan 00	2.43	9	9.5	9.00	12.5	-3	9
B	B. Nadion 02	2.38	9	9.5	10.00	8	1.5	2.25
B	B. Bieha 99	2.37	9	9.5	10.00	8	1.5	2.25
B	B. Knakuyo 05	2.36	7	19.5	12.00	1.5	18	324
B	B. Meteo 97	2.34	9	9.5	9.00	12.5	-3	9
B	B. Bagoun 04	2.33	9	9.5	8.00	17	-7.5	56.25
C	C. To(Kindy) 03	2.27	9	9.5	8.00	17	-7.5	56.25
C	C. Kabouro 04	2.26	9	9.5	9.00	12.5	-3	9
C	C. Gao 00	2.25	9	9.5	8.00	17	-7.5	56.25
C	C. Sanga	2.22	9	9.5	10.00	8	1.5	2.25
C	C. Ton'e 03	2.22	9	9.5	8.00	17	-7.5	56.25
C	C. Nadonon 00	2.18	7	19.5	9.00	12.5	7	49
C	C. Sia 04	2.13	9	9.5	8.00	17	-7.5	56.25
						Σ	d squared=	849.5

$$rs = \frac{1-6(867)}{20^3 - 20} = 0.361278195$$

2		Comparing maintenance to project process						
GROUP	Projects	Total sustainability average	Maintenance	Rank	Project process	Rank	d	d squared
A	A. Kpuri 05	2.58	12.00	1.5	5	8	-6.5	42.25
A	A. Sapouy 97	2.57	11.00	4	5	8	-4	16
A	A. Benavereou 02	2.52	10.00	8.5	5	8	0.5	0.25
A	A. Kayero-Bo (Gogobié) 05	2.51	11.00	4	5	8	-4	16
A	A. Sati 05	2.5	10.00	8.5	5	8	0.5	0.25
A	A. Ly 02	2.48	11.00	4	5	8	-4	16
A	A. Lon 98	2.47	10.00	8.5	5	8	0.5	0.25
B	B. Lan 00	2.43	9.00	13.5	5	8	5.5	30.25
B	B. Nadion 02	2.38	10.00	8.5	5	8	0.5	0.25
B	B. Bieha 99	2.37	10.00	8.5	4	18.5	-10	100
B	B. Knakuyo 05	2.36	12.00	1.5	5	8	-6.5	42.25
B	B. Meteo 97	2.34	9.00	13.5	5	8	5.5	30.25
B	B. Bagoun 04	2.33	8.00	17	5	8	9	81
C	C. To(Kindy) 03	2.27	8.00	17	5	8	9	81
C	C. Kabouro 04	2.26	9.00	13.5	4	18.5	-5	25
C	C. Gao 00	2.25	8.00	17	5	8	9	81
C	C. Sanga	2.22	10.00	8.5	5	8	0.5	0.25
C	C. Ton'e 03	2.22	8.00	17	4	18.5	-1.5	2.25
C	C. Nadonon 00	2.18	9.00	13.5	5	8	5.5	30.25
C	C. Sia 04	2.13	8.00	17	4	18.5	-1.5	2.25
						Σ	d squared=	597

$$rs = \frac{1-6(587)}{20^3-20} \qquad 0.55112782$$

3	Comparing maintenance to institutional arrangements							
GROUP	Projects	Total sustainability average	Maintenance	Rank	intitutional arrangements	rank	d	d squared
A	A. Kpuri 05	2.58	12.00	1.5	9.00	3	-1.5	2.25
A	A. Sapouy 97	2.57	11.00	4	9.00	3	1	1
A	A. Benavereou 02	2.52	10.00	8.5	9.00	3	5.5	30.25
A	A. Kayero-Bo (Gogobié) 05	2.51	11.00	4	9.00	3	1	1
A	A. Sati 05	2.5	10.00	8.5	9.00	3	5.5	30.25
A	A. Ly 02	2.48	11.00	4	8.00	8	-4	16
A	A. Lon 98	2.47	10.00	8.5	8.00	8	0.5	0.25
B	B. Lan 00	2.43	9.00	13.5	8.00	8	5.5	30.25
B	B. Nadion 02	2.38	10.00	8.5	7.00	13.5	-5	25
B	B. Bieha 99	2.37	10.00	8.5	8.00	8	0.5	0.25
B	B. Knakuyo 05	2.36	12.00	1.5	8.00	8	-6.5	42.25
B	B. Meteo 97	2.34	9.00	13.5	7.00	13.5	0	0
B	B. Bagoun 04	2.33	8.00	17	7.00	13.5	3.5	12.25
C	C. To(Kindy) 03	2.27	8.00	17	6.00	18	-1	1
C	C. Kabouro 04	2.26	9.00	13.5	7.00	13.5	0	0
C	C. Gao 00	2.25	8.00	17	6.00	18	-1	1
C	C. Sanga	2.22	10.00	8.5	5.00	20	-12	132.25
C	C. Ton'e 03	2.22	8.00	17	7.00	13.5	3.5	12.25
C	C. Nadonon 00	2.18	9.00	13.5	7.00	13.5	0	0
C	C. Sia 04	2.13	8.00	17	6.00	18	-1	1
					Σ	d squared=		338.5

$$rs = \frac{1-6(337.5)}{20^3-20} \qquad 0.745488722$$

4	Comparing maintenance to community							
GROUP	Projects	Total sustainability average	Maintenance	Rank	community	rank	d	d squared
A	A. Kpuri 05	2.58	12.00	1.5	14.00	10.5	-9	81
A	A. Sapouy 97	2.57	11.00	4	15.00	3.5	0.5	0.25
A	A. Benavereou 02	2.52	10.00	8	15.00	3.5	4.5	20.25
A	A. Kayero-Bo (Gogobié) 05	2.51	11.00	4	13.00	15.5	-12	132.25
A	A. Sati 05	2.5	10.00	8	14.00	10.5	-2.5	6.25
A	A. Ly 02	2.48	11.00	4	14.00	10.5	-6.5	42.25
A	A. Lon 98	2.47	10.00	8	15.00	3.5	4.5	20.25
B	B. Lan 00	2.43	9.00	12.5	15.00	3.5	9	81
B	B. Nadion 02	2.38	10.00	8	14.00	10.5	-2.5	6.25
B	B. Bieha 99	2.37	10.00	8	12.00	18	-10	100
B	B. Knakuyo 05	2.36	12.00	1.5	12.00	18	-17	272.25
B	B. Meteo 97	2.34	9.00	12.5	14.00	10.5	2	4
B	B. Bagoun 04	2.33	8.00	17	15.00	3.5	13.5	182.25
C	C. To(Kindy) 03	2.27	8.00	17	15.00	3.5	13.5	182.25
C	C. Kabouro 04	2.26	9.00	12.5	14.00	10.5	2	4
C	C. Gao 00	2.25	8.00	17	14.00	10.5	6.5	42.25
C	C. Sanga	2.22	10.00	8	12.00	18	-10	100
C	C. Ton'e 03	2.22	8.00	17	14.00	10.5	6.5	42.25
C	C. Nadonon 00	2.18	9.00	12.5	10.00	20	-7.5	56.25
C	C. Sia 04	2.13	8.00	17	13.00	15.5	1.5	2.25
					Σ	d squared=		1377.5

$$rs = \frac{1-6(1377.5)}{20^3-20} \qquad -0.035714286$$