Stakeholder participation and sustainability challenges confronting a small urban community-managed water supply project: Case study of Buea, Cameroon

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Abstract

Community-managed initiatives play an important role in global efforts to meet the Millennium Development Goal for water supply provision of halving the population without access to improved water sources, especially in developing countries. However, in the context of growing urbanisation, these community-managed projects are increasingly intersecting urban areas that by their very nature are at odds with traditional rural community-based management practices. This research examines the case of a small community-managed water supply scheme in Buea, a rapidly growing urban area in Cameroon. The study adopted qualitative research methods (household questionnaires and interviews of community water management and users) and applied choice experiments to better understand the sustainability challenges facing community-managed water supply projects in an urbanizing setting, a phenomenon of growing importance in many developing areas.

This thesis presents and discusses the findings that in urban areas, community-managed schemes face added management and planning pressures because of larger, more diverse, populations and rapid population growth. Therefore they require greater support from government, non-governmental organisations, and development agencies to provide them with improved technical planning capacity and post-construction operation and maintenance support. Furthermore, urban community-managed schemes require strong political and institutional support to uphold their participatory mechanisms that due to the urban context are at risk of failure. Lack of participation has the added consequences of reducing accountability, reducing cost recovery, and impairing financial sustainability. Based on the results of this research in Buea, failing the provision of support, the future of community-managed schemes in urban areas is an unsustainable one, reneging on the Millennium Development Goals and forcing a return to “unimproved” sources of water.

Resumé

Les projets gérés par les communautés jouent un rôle important dans les efforts mondiaux pour atteindre l'Objectif du Millénaire pour le Développement rélatif à l'approvisionnement en eau, en particulier dans les pays en voie de développement. Toutefois, dans le contexte de l'urbanisation croissante ces projets de développement communautaires se trouvent de plus en plus dans les zones urbaines qui, par leur nature même, sont en conflit avec les notions et pratiques traditionnelles de la gestion communautaire rurale. Cette recherche examine le cas d'un projet de gestion communautaire pour l'approvisionnement de l'eau à Buea, une région en pleine expansion urbaine au Cameroun. L'étude a adopté des méthodes de recherche qualitative et a appliqué la modélisation de choix pour mieux comprendre les défis auxquels font face les projets de gestion communautaire d'approvisionnement en eau dans un contexte urbain, phénomène en pleine expansion dans de nombreuses régions en voie de développement.

Les résultats de cette thèse font apparaitre que le contexte urbain rajoute des exigences aux processus de planification et de gestion. Ce qui nécessite un plus grand soutien de la part du gouvernement, des organisations non-gouvernementales, et des agences de développement pour améliorer les capacités techniques de planification ainsi que le fonctionnement et l'entretien des réalisations post-construction. En outre, les projets de gestion communautaires en milieu urbain ont aussi besoin de l'appui politique et institutionnel ferme pour assurer la durabilité de leurs mécanismes de participation qui sont de plus en plus difficiles à soutenir en zone urbaine et sans lesquels la viabilité financière de ces projets est mise en doute. A défaut d'appui, l'avenir des projets communautaires d'approvisionnement de l'eau dans les zones urbaines risque d'être compromis, affectant la réalisation des Objectifs du Millénaire pour le Développement et obligeant un retour aux sources d'eau insalubres.

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1. Introduction

1.1 The Millennium Development Goals

Much emphasis has been placed over the past decade on the fulfilment of the United Nations' Millennium Development Goals (MDG). Target 7C of halving the world's population without access to improved sources of water has been responded to enthusiastically and many parts of the world are set to reach, or even exceed the target. The importance of water to human life has resulted in the aim of fulfilling MDG 7C being addressed through various local, community and private sector initiatives (Spencer et al. 2008), yet there is no consensus on the best type of initiative to focus on to contribute to the target. The ongoing debate about the privatization of water services in developing countries encompasses questions of water as a human right on the one hand, and concern that privatization will further marginalise low income groups' access to water on the other. According to Budds and McGranahan (2003) privatization is generally driven by broad political trends rather than evidence and experiences from the water sector. In fact, Budds and McGranahan conclude that there is no justification for continuing to promote private sector participation as a means of achieving the MDG targets. Hence, the relative importance of the other initiatives, public sector and community initiatives increases. There is evidence that demand-driven community initiatives are able to deliver sustainable results in water provision (Whittington et al, 2009), and indeed, community management is being applied widely (Njoh, 2003). However, the caveat as explained by Harvey and Reed (2007) is that some community water initiatives are established without sufficient ongoing institutional and technical

support and as a result do not end up providing the originally intended levels of service sustainability.

Effectively, the quality of management can either make or break the effectiveness of any system, including that of a community-managed water system. Community-managed water systems, in the context of this thesis, are *small water supply networks* serving small *rural or urban communities* established by governmental, non-governmental, or private actors, that are *operated and managed locally* by members of the community who are *neither highly skilled nor professional* water managers using situation and skill-*appropriate technology*. Because of this nature, these essentially volunteer-run networks require some support in order to function effectively. There is much mention in the academic literature about distribution system failures on the one hand, and on the other there are success stories due to effective implementation, which will be discussed later in the literature review. This research seeks to put the literature into context and apply it to the particular case of a *community managed water supply system in an urban setting*, by examining the challenges facing a small urban community water supply scheme in Buea in the Southwest Region of Cameroon.

1.2 Buea's water crisis

The Republic of Cameroon, in Western Africa, was formed at independence in 1961 from the merger of the two colonies of French Cameroun and British Cameroons (Figure 1.1).

Figure 1.1 Location of Cameroon in Central Africa and Mount Cameroon Region (Fako)[1]

Buea is located in the Southwest (Sud-ouest) Region, in the Fako District at the foot of Mount Cameroon, the country's highest point at 4,095 m above mean sea level (CIA, 2009). Buea's elevation ranges from 500 m to 1200 m above mean sea level. The climate is relatively wet, tropical, and equatorial. The region is characterised by dense vegetation, a hot and humid climate, and abundant rainfall, ranging from 2000 to 5000 mm per year. However, Buea and its surrounding villages (Figure 1.2) are located in the rain shadow of Mount Cameroon and due to the orographic effect receive a little more than 2000 mm of average annual rainfall. Most of this precipitation falls during the wet season from April to October.

[1] Open-license map from CIA World Factbook, 2004 version.

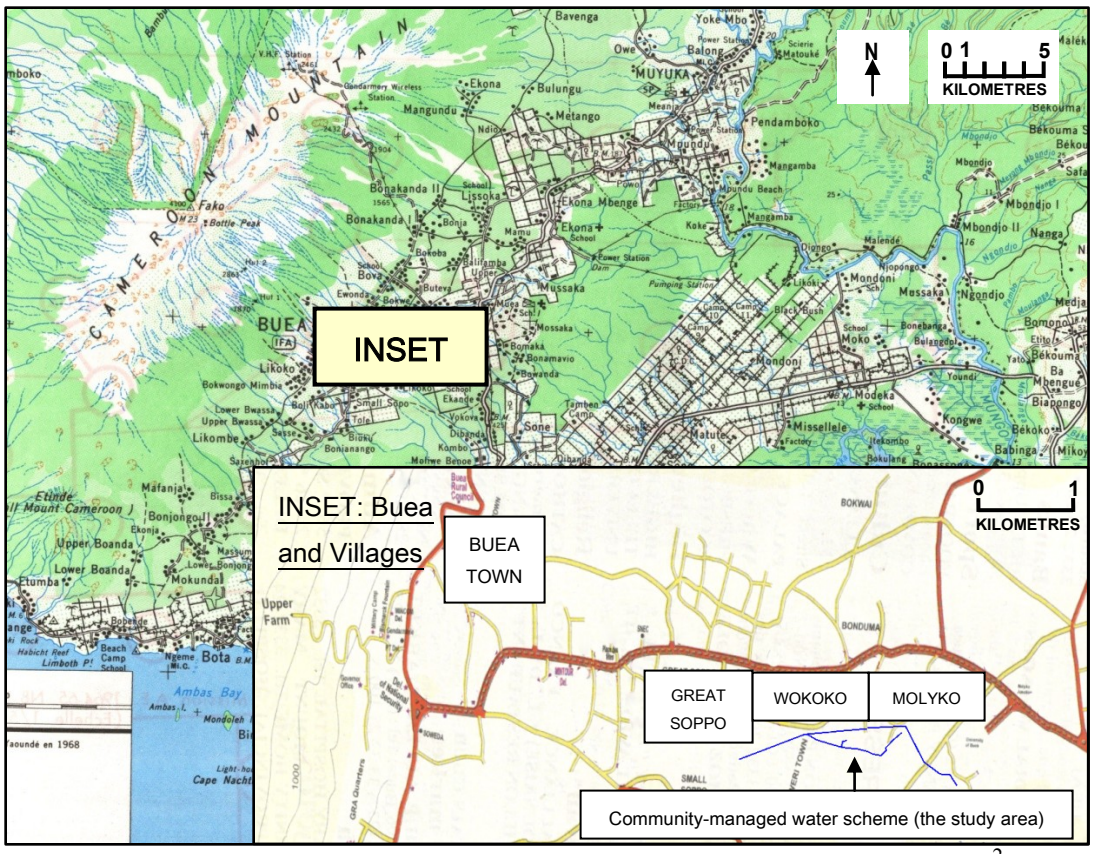

Figure 1.2 Location of study area in Buea in Mount Cameroon Region[2]

Today, inhabitants of Buea obtain their drinking water from several sources: the water utility's household connections and public stand taps, community water schemes and also open streams and natural springs. The former national public water utility Societe Nationale des Eaux du Cameroun (SNEC), now Camerounaise Des Eaux (CDE) which is discussed in more detail below, has a water distribution network covering the older areas of Buea through private connections and public stand taps. The network is old, some parts dating back to German colonisation and the late 19th century, and it only covers part

[2] Reproduced from Institut Geographique National (France), Centre de Yaounde. (Cartographer). (1961). *Carte generale du Cameroun* and CTIC (2007). *Le Cameroun: Guide pratique du voyageur*. Editions Wala

of the modern town. Buea is the historic capital of the colonies of German Kamerun and later of the British Southern Cameroons. Its political importance to Anglophone Cameroonians in the unified independent Republic of Cameroon led it to being the site of the first Anglophone university in Cameroon, the University of Buea, in 1993. Since the establishment of the university the town has seen a dramatic increase in population and urbanisation, which has resulted in the strain on its water resources seen today. Buea Town itself has a population of only about 47,000 (Republique du Cameroun, 2006) but it is surrounded by a built up area of about a dozen villages that make up the Buea urban area, with a population of almost 200,000 (Buea Rural Council). The population density in this area is 175 people per square kilometre, compared to the country's average of 34 (Republique du Cameroun, 2006).

The "water crisis" as it is known locally, is a result of (1) demand exceeding supply and (2) the poor management of current water supply infrastructure. Furthermore, Buea's water supply shortfall is happening despite the relatively abundant annual rainfall and natural water resources in the region. The first factor, excess demand, is a result of the influx of migrants to the region after the University of Buea was established. The second factor of poor management is, however, a more complex issue to understand, for which one must examine the different water providers in Buea. Water provision in urban areas was predominantly the responsibility of the government utility SNEC (Societe Nationale des Eaux du Cameroun) until recently. In 2005, the government approved the restructuring of the water sector under the guidance of the World Bank and International Monetary Fund (IMF 2000): SNEC would be taken over and replaced by a public-private

partnership comprised of the public Cameroon Water Utilities Corporation (CAMWATER) and privately operated CDE. CAMWATER is a government body responsible for the planning and investment of water-related infrastructure. CDE is a privately operated company managed by the current lease holder, the Moroccan Office National de l'Eau Potable (ONEP), and is responsible for the production, distribution, maintenance, and commercial activities of water supply (Folifac, 2009). In operational terms on the ground CDE is effectively SNEC with some additional management (hereafter referred to as SNEC/CDE when discussing the utility and as CDE when referring to its current operations). The objective of the restructuring was to improve the utility's efficiency and to improve water coverage; effectively, one of the contractual obligations of this restructuring is that CDE increases the number of water subscribers and the volume of water supplied to households. It is too early to assess the impact of the restructuring. Up until the change, access to improved water sources had increased steadily to a country average of 70% in 2006. However, there was a wide disparity of service provision between rural and urban areas, with access at 47% in rural areas and 88% in urban areas (World Bank, 2009).

In the Buea region, matters are complicated because the division between rural and urban is blurred. Buea, as previously stated, is an urban area comprised of Buea Town (the primary urban zone) surrounded by rural communities and villages that today have effectively been incorporated into the Buea urban area. Due to the demand for water in these villages, and the past lack of provision to these local areas by SNEC/CDE, community water supply schemes that exploited local spring water sources were created

with NGO and municipal council support. As a result, today, urban Buea is served both by community water schemes and CDE supply. Proponents of decentralisation of water supply may regard this positively, but this mix has lead to a breakdown of coordination between SNEC/CDE and community water to effectively manage Buea's various natural water sources and supply water to its inhabitants in a concerted effort. As an example, the water sources exploited by SNEC/CDE's network are at their full capacity, but any efforts by CDE to expand their supply by exploiting new sources is hampered by the fact that most viable sources in Buea are already being exploited by community schemes. Although a detailed study of the physical water availability in Buea has not been carried out, the relatively high rainfall and abundance of natural springs suggests that there is a sufficient quantity of renewable water resources in the area to support at least the current population. However, the combination of disjointed exploitation of water sources by different parties with different technical and financial capacities, and poorly conceived and poorly managed community water supply schemes has resulted in an inefficient use of Buea's natural water resources and the subsequent "water crisis".

1.3 Objectives, significance, and background of the thesis

This thesis will examine the problems with community water, one of the several factors affecting Buea's "water crisis" described above. Many community water supply schemes are poorly managed or inefficient, but are sometimes the sole accessible source of potable water for local inhabitants, hence the significance of this thesis. Paths out of Buea's "water crisis" could involve CDE expansion and improvement of potable water supply, and/or improvement of urban community water supply schemes. The development and

expansion of the CDE network is highly dependent on political initiatives and government policy and is a traditional "top-down" supply driven method of addressing the crisis. However, community schemes represent a different, promising methodology: they are small, local community driven initiatives with low-technology solutions and require low capital costs with the potential to become self-sufficient. Communities have more direct involvement with the definition of problems and planning of solutions with theoretically better tailored, efficient solutions. Yet these schemes are still faced with challenges that threaten their effective and efficient operation in the long term. Some schemes suffer from irregular water supply, many are supplying untreated water, and others find it difficult to truly be financially and operationally viable.

These are serious implications when it comes to understanding what progress towards meeting MDG 7C means. The success of MDG 7C depends partly on the effectiveness of community water schemes, and their ability to provide users with sustained improvements in potable water supply. Therefore, this thesis examines one such small community water supply scheme as a case study of the challenges facing a small urban community water supply schemes, and identifies the factors behind the challenges while proposing improvements for the future.

1.4 The Great Soppo, Wokoko, Molyko Community Water Supply Scheme

The Great Soppo, Wokoko, Molyko Community Water Supply Scheme--named after the respective villages served by the scheme (see Figure 1.2) and which will be referred to as the GWM Scheme--was envisioned in the late 1990s as a potable water supply system for

the inhabitants of those areas who lacked basic potable water supply. Before the scheme, users relied on “unimproved” water sources, such as open watercourses or on public stand taps provided by the municipal council, but that were located several hundreds of meters away from their homes. A source of potable water was needed because at the time that the original SNEC distribution network was constructed, the area in question was farmland, and it was not foreseen that someday the area would become more densely settled.

The three villages are located on the slopes of Mount Cameroon; Great Soppo is at an elevation of about 700m, Wokoko is around 600m and Molyko is around 550m above sea level. The implementation of the project was conceived of as a three phase process. The first phase, which is the only one currently in operation, is a gravity-driven network serving the communities of Wokoko and Molyko, the two villages downhill from the village of Great Soppo, using a water source located in Great Soppo. Although most residents in Great Soppo do not benefit from the gravity-driven piped distribution network of the GWM scheme because they are at the same elevation as the source of the network, users in Great Soppo have access to the source itself, which is used as a point source by residents in the immediate vicinity. The second phase of the project would have continued downhill and served the University of Buea in Molyko, however, that part was abandoned because of difficulties in maintenance due to vandalism. The third phase would have been to supply the village of Great Soppo with water, by pumping water to a tank at the highest point in Great Soppo and distributing it to the village. The

implementation of this phase was also abandoned because of lack of funds and logistical difficulties of providing power for the pumping process.

The major actors involved in the conception and eventual construction of the GWM scheme in 2001 and 2002 were: residents of the local communities of Great Soppo, Wokoko, Molyko; Buea Rural Council; Organisation for Sustainable Rural Infrastructure (OSRI), NGO – Kumba, Cameroon; and Helvetas Cameroon, NGO – Bamenda, Cameroon. The GWM scheme was constructed in 2001 and 2002 at a cost of around 70,000,000 CFA (Helvetas Cameroon, 2006) equivalent to about 150,000 CAD in January 2002[3]. To date, the scheme provides water to approximately 80 to 100 households. The scheme was set up with the assistance of the Swiss development agency Helvetas, who provided technical and financial assistance in partnership with local NGO's and beneficiaries. The local NGO OSRI planned and built the scheme with help from members of the local community, who contributed financially and provided manpower.

A participatory process including local consultations was carried out. After construction, the scheme was handed over to the Buea Rural Council. From the outset, the scheme was intended to be community managed with a trained functional management committee in place, as described in the Helvetas Cameroon (2007, p.5) report on the sustainability of their interventions in Cameroon. A functional management committee would be in charge of operation and maintenance of the scheme, hold regular meetings, have a bank account

[3] Historical exchange rate obtained from http://www.xe.com/ict

and keep records (Helvetas Cameroon, 2007, p.5). They should also have the authority to be able to track and punish defaulters who refuse either to pay dues or to participate in community work. The outcomes of this research will describe and analyse the actual effectiveness of the GWM Scheme's management on the ground.

1.5 Research Questions

One of the major challenges of community water supply schemes is ensuring financial sustainability and self-sufficiency. According to Carter et al. (1999) many schemes fail operationally because the financial costs that communities are expected to contribute are impracticable or unacceptable, or communities may never have felt ownership of the infrastructure so that repairs and maintenance are not carried out. Carter et al. (1999) also found that even in cases where full community participation or management has been planned, the community management system breaks down as committees and caretakers lose interest or move away, and this is a particular risk if community organisation is on a voluntary basis. The fact that the GWM scheme embodies a community approach in an urban setting provides an interesting case to study the implications of urbanisation on the community management paradigm. The research questions explored are (1) to determine the barriers to financial and operational sustainability of an urban community scheme and (2) to understand the potential for an urban community scheme to be self-sufficient and financially viable through cost recovery by user fees. In order to understand the first question, one must understand the problems facing the management team of the urban community scheme and understand how and why community management mechanisms may break down in an urban environment. To understand the second question, one must

look at users' willingness to pay and understand what affects users' perceptions and expectations of, and satisfaction with community water. Through the research into this second question, the practical challenges facing this community water supply scheme will be highlighted, since these operational challenges and failures contribute to users' satisfaction with and willingness to pay for community water supply. Thus, this research will answer these questions using the case study of the Great Soppo, Wokoko, Molyko Scheme and a methodology combining field visits, personal observations, and qualitative data obtained from stakeholders in the community scheme. The findings will contribute to the understanding of effective implementation of community management in an urban setting and will provide the background to inform future management decisions for the GWM community scheme.

1.6 Organisation of the thesis

The introduction is followed by a review of the literature related to: (1) community-managed water schemes, (2) which factors contribute to the sustainability of community managed water supply, (3) effective community participation, (4) description of the participatory action research (PAR) method, and (5) using choice experiment methodology to evaluate willingness to pay in the water sector. This is followed by a description of the research design and methodology and the type of data collected.

The results section begins with data on the Great Soppo, Wokoko, Molyko community water scheme chronicling the development of the scheme to the present day, and subsequently characterising the scheme's operational problems and their implications.

This leads into thematic discussions of how the problems arose, highlighting the "hard" side: the physical and planning deficiencies of the scheme and its inability to cope with the management and planning pressures arising from the urban context and highlighting the importance of ensuring ongoing technical support for community-managed projects. The next section launches into a discussion of the "soft" side: inadequacies of the standard community model in the urban context and how those management challenges combined with the "hard" side physical deficiencies of the network result in sustainability problems. The next aspect that is examined builds on the analysis so far and proposes improvements to the financial sustainability of the scheme by examining the barriers to user fee cost-recovery and how to overcome them, and understanding community water users preferences. The role community water plays in Buea and how it is perceived by the different genders is also discussed. This understanding of community water users' priorities determines the scheme's potential for cost recovery, and the subsequent section explains how best to target investments in the scheme in order to maximise the utility that users derive from it, which is fundamental to a well-designed community project. The final section presents a summary and some concluding remarks.

2. Literature Review

This thesis examines the sustainability challenges facing a community-managed water supply scheme and its potential to be financially self-sufficient and sustainable. The concepts that will be covered in this review include: a description of community-managed water projects, an appraisal of the concept of sustainability of community water supply in the literature, an examination of effective community participation, an overview of participatory action research, and an explanation of the use of choice experiments to model preferences in the water sector.

2.1 Community-managed water supply

There is a trend towards decentralisation in the provision of water supply and sanitation to the hundreds of millions of people who lack them. Agenda 21 of the Earth Summit in Rio de Janeiro in 1992 outlined a strategy for sustainable development in the 21st century. A guiding principle according to Lammerink (1998) is "community management of services backed by measures to strengthen local institutions to implement and sustain water and sanitation programmes." Community-managed water supply is generally understood among NGOs, governments, and individuals in the international development community to be low-technology, non capital-intensive projects. Members of the local community, who only receive basic training and are not necessarily professional, trained water managers, are expected to participate significantly in planning and post-construction management of the schemes and to ensure that the projects become financially self-sufficient.

The notion is increasingly popular with advocates of social justice since the 2000s as it became more apparent that the privatisation of water supply initiated in the previous decades was not benefitting poor households (Bakker 2008). As a result there is a growing trend towards community-managed water supply projects in developing countries, where rural communities are being encouraged to participate in planning, management, and operation of their own water supply schemes with the help of supporting (governmental) agencies and NGOs (Bakker 2008; Rondinelli 1991), with several examples in Africa (Gaye and Diallo 1997; Kaliba 2002; Kleemeier 2000; Kyessi 2005; Lyons and Smuts 1999; Mann 2003; Njoh 2003a; Sun 2010) and Latin America (Whittington et al 2009). These various examples are used to understand the factors behind the successes and failures of these projects. The trend is that while some early projects were unsustainable, lessons were learned from these initial experiences, which improved the sustainability of projects that followed. Some community projects therefore continue to be successful to this day, including a large community-managed water supply system in Kumbo in the Northwest Region of Cameroon (Njoh 2003a) as well as more recently established, smaller community systems in Ghana and Bolivia (Whittington et al 2009). However, some projects continue to function but are in poor financial shape putting future operation at risk, some continue to function but face operational and maintenance difficulties, and some no longer function at all. Community-managed projects are an important component of development efforts in water supply and sanitation, so several NGOs and international agencies such as the Swiss development agency Helvetas and the World Bank have published training manuals and lessons learnt from their experiences (Helvetas – Van der Waarde and Ischer 2007; Helvetas 2002;

Helvetas Cameroon 2007; Helvetas Cameroon Tool 1.2; Leermakers 2000; World Bank – Castro et al 2009) outlining the factors contributing to the success of community-managed water supply projects. The comprehensiveness of these guidelines and manuals is varied—the World Bank manual is very detailed and provides a well structured training course tailored to the particular case of urban community managed water supply in Dar Es Salaam, while the Helvetas documentation is much more general, drawing from varied experiences from nearly half a century of experiences in many regions of Cameroon and provides general guidelines for important components of projects such as local ownership, securing commitments from local councils, and the role of Helvetas in procuring technical and financial support. Sustainability of community water projects is examined in more detail in Section 2.2.

2.2 Sustainability of community water supply

The concept of sustainability in development was defined by the Brundtland Commission as the ability to meet development needs without compromising the ability of future generations to meet their needs (Brundtland 1987). It is a combination of different targets, comprising environmental, economic, social and institutional criteria of equal importance (De Carvalho et al, 2009). The concept can be applied to many fields, and represents a shift in ideology that is underway especially in the policy, planning, and development fields. According to Gasson (2000), a "sustainable city meets its present and future human development objectives without growth in the throughput of matters and energy beyond the regenerative and absorptive capacities of its local, national or international hinterland." De Carvalho et al., (2009) also describes a sustainable system as one that

emulates nature and its functions, the idea being that nature's course is sustainable and that engineering designs should reflect this as much as possible. Another important concept is that sustainability is not a fixed or constant goal but is time and space-relevant (Ibid), being dependent on current knowledge and goals.

A further elucidation of what constitutes sustainability is provided by Valentin and Spangenberg's (2000) "prism of sustainability." The prism in this case consists of four dimensions: social, economic, environmental and institutional. Each corner of the prism represents an aspect of sustainability and different sustainability goals can be situated along different planes in the prism accordingly. In a more applied vein, De Carvalho et al. (2009) designed their Sustainability Index for Integrated Urban Water Management (SIUWM) using 5 components of sustainability: *social/cultural* related to social fairness and equitable distribution; *economic* comprising economically sound principles, economic growth and cost returns; *environmental* including environmental protection and preservation of ecology; *political* meaning continued support and international stewardship; and finally *institutional/technological* comprising of sustained capacity and technological progress. A more strictly management perspective of sustainability is Carter's (1999) "sustainability chain," which suggests that the steps to sustainable project management include *motivation*, *maintenance*, *cost recovery*, and *continuing support*.

However, when it comes specifically to implementing sustainability into water supply projects, especially in developing countries, despite some of the earliest literature on the sustainability of water projects being published in the 1990s, very little work has

translated sustainability into the specific context of community water supply projects, which arguably require the most support and are the most marginalised type of project. It seems that the lack of sustainability in community managed projects is a consequence of poor management. Rondinelli (1991) outlines six factors affecting community management of water supply: (1) adequate incentives, (2) sufficient skills and resources, (3) appropriate processes such as local campaigns, procedures for consultation and participation of community groups, and sharing of responsibility (4) effective interorganisational relationships among national government agencies, community organisations, NGOs, local government, (5) appropriate technology, and (6) effective monitoring, evaluation, and feedback. Muyibi (1992) details some of the oft-cited factors that contribute to project failures in rural areas including choice of inappropriate technology, lack of effective backup support, non-involvement of the user community in planning and implementation, and implementation of projects for political gains. Ideally, community water management is an approach in which a supporting agency no longer solely provides technical or financial assistance but facilitates processes that increase the community's capacity to manage its own water system (Fonjong et al, 2003).

Lee and Schwab (2005) describe the lack of sustainability in many drinking water distribution systems in developing countries and review some of the recommendations in the literature including routine and preventive maintenance, cost-recovery in the form of adequate pricing and careful billing, and monitoring and evaluation of services provided. However, some of these recommendations cannot be transposed onto a small community managed water scheme. For example, the cost-recovery attribute is more difficult in

community schemes as noted in Carter (1999), one of the reasons according to Evans (1992) being that some users still have a village mentality and continue to be attached to their traditional free sources of water. People must understand the potential advantages of improved water and sanitation such as improved quality, quantity, and more convenient and reliable service, which should then encourage payment and cost-recovery; this education and sensitization is part of ensuring sustainability of community managed water. Furthermore, to ensure long-term financial sustainability and to eliminate continued dependence on external funds, "demand-driven" solutions are necessary, enabling cost recovery through user fees (Whittington et al. 2009). Evans (1992) details the factors influencing willingness to pay for community water and sanitation (Table 2.1).

Whittington et al.'s (2009) study of community managed rural water supply systems in Peru, Bolivia and Ghana found that although the systems were in poor financial shape, they were in working order. The "demand-driven" community management model coupled with post-construction support (access to spares and technical expertise) successfully kept the systems working despite their lack of financial self-sufficiency. These systems were kept functioning by the contributions of NGOs, religious groups, and non-state actors, but Whittington et al., suggest that NGOs should be a catalyst for and provide post-construction support rather than act as a dispenser of capital subsidies that may undermine communities' own cost recovery efforts, thereby working to foster "demand-driven" development. The "demand-driven" aspect means that participation is encouraged and included from the beginning, involving households in technological choice and institutional/governance arrangements, giving women a larger role in

decision-making, and making households pay all of the operation and maintenance costs and at least some capital costs. The demand-driven model represents a success in community water management, however, Whittington et al. (2009) note that the next step is to ensure financial self-sufficiency that will allow communities to carry out their own system rehabilitation and expansion.

Table 2.1: Factors influencing willingness to pay for community water and sanitation (from Evans 1992). Bold factors are those that can be influenced by effective participation.

• Service standard	• Characteristics of existing sources
• **Perceived benefits**	• **Community cohesion**
• Relationship to production	• Policy environment
• Level of income	• Socio-cultural factors
• **Price**	• **Perception of ownership and responsibility**
• Relative cost	• **Transparency of financial management**
• Opportunity cost of time	• Institutional framework
• Reputation of service agency	

Table 2.1 Factors influencing willingness to pay for community water

2.3 The importance of participation

Community participation is becoming a buzzword in the development literature. It can variously consist of participation in decision making and design, community contributions, representation of community diversity, community taking on ownership and responsibility of the project and having authority over decision making (Kaliba 2002; Narayan 1995b; Paul 1987; Yacoob and Walker 1991). However, it is often misunderstood and used interchangeably with community management; community participation is a distinct concept from community management, as community-managed

projects can be implemented without effective participation and conversely, effective participation mechanisms can be implemented in projects that are not community-managed. In her critique of the concept of "community," Bakker (2008) notes the fallacious assumption by proponents of the concept that community management equals greater accountability. Ownership is less important than the institutions or governance involved. What makes community management effective in increasing accountability is actually the institution of effective community participation which is usually embodied in community management. In that sense, effective community participation is a necessary condition for enabling many of the community management sustainability criteria discussed in the preceding paragraphs. Bakker (2008) also notes that the literature tends to romanticise communities as equitable social structures; again, effective participation is the key to ensuring that community management successfully represents the interests of all stakeholders. Returning to Table 2.1, the willingness-to-pay factors highlighted in bold are those that can be affected by effective community participation, supporting the notion that effective participation is necessary for the financial sustainability of community managed projects. For example, in Table 2.1 *perceived benefits* of a water supply system are influenced by users' understanding of the attributes of the water supply and how well the water supply matches users' expectations, both of which are enhanced by community participation. Similarly, an appropriate *price* is decided upon through effective community participation. *Community cohesion* and *perception of ownership and responsibility* are directly enhanced by greater community participation and an appreciation that the project is communal. Community participation can also encourage

communication between community and management leading to better *financial transparency*.

Fonjong et al. (2003) and Njoh (2003a) describe self-help community infrastructure projects that have been implemented in other communities in Cameroon. Self-help projects are those projects carried out with significant contributions from local communities, involving them in self-determination, providing them with tools, training and capacity to carry out appropriate projects with community participation (Njoh, 2003a; 2006). Theoretically, these projects should address the sustainability criteria noted above, and by their very nature, are participatory. There is a long history of these projects in Cameroon, dating back to colonial times. Colonial authorities provided training to community development technicians and sought labour and financial contributions from local populations in the development of communal infrastructure projects (Ibid). Fonjong et al. (2003) describes the socio-economic benefits of these self-help ventures but also documents that the management of potable water is a "herculean task for most communities after the departure of funding partners." Therefore there still seems to be a breakdown of sustainability in some projects, despite their participatory, self-help nature, which begs the question, what is *effective participation*.

Effective participation enhances the participation of women and youth (Kaliba 2002; Njoh 2002). Njoh (2002; 2003b) discusses some of the barriers to effective community participation in his case study: governance issues such as paternalistic local authorities and excessive state intervention can reduce participation because of selective

representation and inhibition of participatory platforms. Furthermore, communities can lose interest and stop participating because of loss of faith due to delays to the project's completion and because of soliciting of contributions well above the projected amount and beyond the projected date of completion (Ibid). Njoh (2006) documents the success of the Kumbo community water scheme in Cameroon. The strength of this scheme was strong community awareness, and cohesion that was enabled by a relatively homogenous population with a strong traditional hierarchy. This is further supported by Sun et al.'s (2010) study of community-based water and sanitation committees (WATSANs) in Ghana, where communities with more existing community groups are more likely to have functioning WATSANs while ethnically diverse communities are less likely to have these organisations. Sun et al (2010) also note that giving authority to WATSANs regarding the choice of contractors in charge of building the infrastructure and giving authority to express discontent with contractors' work might be important to support the functioning of WATSANs.

Kleemeier (2000) notes from her research in Malawi that the size of the water supply scheme is important; Njoh (2002) also found that the participatory model works better for smaller schemes. The standard participatory model sets up the institutional framework for maintaining very small rural piped gravity schemes, but larger schemes are more likely to run into problems that would require technical and financial input from the Government's Water Department. Furthermore, Kleemeier notes that the Malawian schemes need more management and repair capacity than volunteer committees can offer, and speculates whether compensation would improve performance of the committees.

2.4 Participatory Action Research

This section and the next one review the literature relating to the methodology used in the thesis, which will be explained in more detail in section three. The research methodology was inspired by Participatory Action Research (PAR) in which the research takes on a more applied role such that the roles of researcher and participant begin to intersect. PAR is described in Kapoor and Jordan (2009, p.2) as being part of the wider movement of democratization and of depoliticizing decision making. Participants are brought together to reflect and act on their own social practices, to shape their own research and to discuss and act upon the outcomes (Ibid, p.89). Discussions are two-way, with researcher and participant actively engaged, leading to improved dissemination of the research to the stakeholders such that research remains grounded closer to reality. PAR allows communities and supporting agencies to share, analyse and increase their understanding of the research issues and allows them to effectively plan and implement solutions (Lammerink 1998). Some of the critical issues being dealt with in PAR literature are (1) the use of PAR as a 'buzzword' despite not embracing the researcher/collaborator partnership, which should include diverse collaboration and (2) PAR that embraces "facile notions of participation" that are ultimately just new forms of exclusion (Kapoor and Jordan 2009, pp.119-120).

2.5 Choice experiments in the water sector

Willingness to pay and consumer valuation of goods and services are valuable inputs to the design of any policy or infrastructure project. Stated preference techniques employ hypothetical scenarios to elicit whether respondents would participate in a specified price

and alternative choice. Stated preference techniques have been used extensively in the environmental field (Adamowicz et al 1998; Hanley et al 1998) because they are able to explore ranges of parameters for environmental goods that are not available on the market. There are two main stated preference techniques: contingent valuation (CV) and choice experiments. In contingent valuation, a proposed change is described in detail, and the respondent is usually asked to give an estimate of what the change is worth to them through a bidding game or open-ended question (Virjee 2006). In a bidding game, the respondent is required to either accept or reject a suggested value for the hypothetical change, and CV has been criticized for inducing a bias towards acceptance because of the hypothetical nature of the proposition (Ibid). On the other hand, CV methods usually provide a numerical estimate of a certain hypothetical change or bundle, but provide little information regarding relative values of attributes in a bundle and tradeoffs between these attributes. This thesis focuses on choice experiments, which are more successful at analysing these tradeoffs.

In choice experiments, sets of choice bundles are presented to the respondent, each bundle comprising of predetermined attributes set to different levels. For example, when administering a choice experiment about water supply, different attributes could be water quality, water pressure, and flow reliability; the levels could be high or low water quality, high or low water pressure, 5 days a week or 7 days a week of flow reliability. A price attribute is also assigned. Respondents choose among discrete choice bundles (sample choice set in Figure 2.1). The choice experiment estimates the utility the respondents derive from each changing attribute by fitting a multinomial logit model to the response

data. The model estimates the probabilities of respondents selecting each level of an attribute and also assigns an implicit price associated with each level of an attribute (Virjee, 2006). These probabilities are estimates of the relative utility that respondents derive from each attribute. Important considerations in the design of choice experiments are orthogonality of design such that sets of choice bundles do not repeat themselves in different questions because this would make some questions redundant, and efficiency is also important. Both aspects are facilitated by computer-generated experimental designs (Kuhfeld, 1994). Ready-to-use algorithms and modules for the design and analysis of choice experiments are available in statistical software packages such as SAS and JMP (Cox, 2009; Virjee, 2006).

WATER RELIABILITY
Residential Questionnaire

	PACKAGE A	PACKAGE B
Number of times water is unavailable to your home:	1 time per year	2 times per year
Length of time that water is unavailable to your home each time that it goes off:	8 hours	5 hours
Time of day that water is unavailable to your home each time that it goes off:	Over the weekend	Mon-Fri sometime after 8am
Prior notification that water will be unavailable to your home:	1 day	2 days
Response to phone inquiries in the event of water becoming unavailable to your home:	You get straight through to a PERSON - you are not put on hold and there is no machine directing you to press buttons	You get straight through to a PERSON - you are not put on hold and there is no machine directing you to press buttons
Total Water & Sewerage bill for the year:	**$800**	**$850**

YOUR DECISION: If these were the only 2 options available to you, which option would you choose: Package A or Package B ?

Figure 2.1 Sample Choice Experiment Set (reproduced from Hensher et al 2005)

2.6 Summary

The issues in the literature cited above do not analyse community management in the urban context, because it is more common for community managed water schemes to be implemented in rural areas. However, community managed infrastructure projects are seen in several urban case studies and are a promising alternative to centrally organised, top-down infrastructure projects in developing cities (Gaye and Diallo, 1997; Kyessi, 2005). Furthermore, the highest urbanisation rates and urban populations are projected in Sub-Saharan Africa and Asia (Montgomery, 2008). A sustainable community managed project is one that continues to provide the intended services throughout the intended service life. The sustainability of community managed schemes involves a combination of effective participation, self-determination and motivation, capacity, cost recovery, and continuing support. Effective participation is a necessary condition for community management to function, enabling many of the other sustainability criteria to be met. It appears that community managed schemes continue to fail, despite better understanding of, and efforts to implement, community participation. Hence, this thesis will elucidate some of the characteristics and causes of failure in an urban community managed scheme using qualitative research methods, methodology inspired by participatory action research, and choice experiments.

3. Methodology

3.1 Field visit

It was established early on that a field visit to Buea would be necessary to carry out the research, for the purposes of study area familiarization and field data collection. A two-month field visit was made between October and December 2010. The timing of the trip was influenced by the fact that Buea would be transitioning from the rainy season (April to October), with abundant water supply and diverse water sources, to the dry season (December to March), which is characterised by little or no rainfall and reliance on a few, particular sources such as standpipes. Working in the rainy season would have been logistically difficult due to the heavy precipitation. Due to logistical constraints, only one field visit could be organised, so it was hoped that the collection of quantitative and qualitative data from the transition period would present (1) an accurate depiction of community water use during relative abundance of water, while (2) being close enough to the onset of the dry season to document the impending issues and coping strategies during relative scarcity of water.

3.2 Definition of research and choice of study area

There are several urban community water supply schemes in Buea, but the Great Soppo, Wokoko, Molyko Scheme was chosen because of convenience and the availability of contacts. The first interview with the chairperson of the Water Management Committee established a brief background and context of the scheme, and the main problems facing the Committee. This information helped to focus the research on financial and operational

sustainability of the GWM scheme. Several sources of data were decided upon: personal observations and physical data, interviews, and questionnaires.

3.3 Personal observations and physical data

Personal observations were made by the researcher during the entire two-month period. These observations were important for shaping the research, providing a general understanding of the context behind the "water crisis," and the social implications and characteristics of water use in Buea.

Observations specific to the GWM scheme were also made. The researcher accompanied one of the Scheme's technicians to the site of the distribution network and was introduced to some of the residents. Upon a second visit to the scheme, a survey of the layout and dimensions of the distribution network was made with the aid of a Garmin eTrex Vista HCx Global Positioning System (GPS) unit. Additionally, dimensions of the storage tank and intake pipes were taken, and an estimation of the flow was attempted at the spring water source of the GWM scheme. These physical data were used as general engineering background to inform the data analysis, but were subject to large inaccuracies in the measurement of stream velocity due to the unavailability of appropriate equipment. These errors prohibit the data from being used as a basis for future final designs for the GWM scheme (Appendix VI).

3.4 Interviews

Interviews were carried out by the researcher with the chairperson of the Water Management Committee of the GWM scheme, who was the sole remaining active member, and with a technician of the GWM scheme. Interview guides were prepared beforehand for both, but both followed an informal interview style, as dictated by the setting. Audio recordings and transcriptions of the chairperson interviews were made (Appendix I). The users' perspectives were obtained from the questionnaire (Appendices II, III and IV) and associated informal interviews arising from the open-ended questions, described in Section 3.5.

Furthermore, after the data collection phase, initial findings were presented to the chairperson of the Water Management Committee, as inspired by PAR methodology in which research findings are disseminated to and discussed with participants. This influenced the announcement of a general meeting of the Water Management Committee and some residents of the community to discuss improvements and changes to the current system, which was also audio-recorded and transcribed (Appendix I).

3.5 Questionnaire

In order to assess the cost-recovery potential of the scheme through user fees, a questionnaire was devised to understand barriers to payment, users' expectations, and satisfaction of the water supply while incorporating choice experiments to understand their valuation of community water and willingness to pay. The questionnaire data also described users' water use behaviour such as which alternative water sources were used,

and it quantified rainwater harvesting. It elucidated how users responded to rainfall unpredictability and community water failure, and also exploited users' experiences to understand the history and factors behind the failure of community water (see Appendix II).

Sampling

Since the GWM scheme serves approximately 100 households, a random sample of 46 households was deemed adequate and was obtained using a random sample in the direct vicinity of the distribution network. The researcher and assistant conducted a random walk around the network on several days between the 8th and the 18th of November 2010.

Design

A questionnaire guide was designed with some input from the local research assistant, who was proficient in both Standard English and Pidgin English, the lingua franca. Several open-ended questions were included in the questionnaire in order to thoroughly understand issues such as payment, coping strategies, and experiences (see Appendix III). In order to ensure that questions were understood and to accurately transcribe responses, questionnaires were administered individually, door-to-door to household heads, and each session was conducted more like an interview, where follow-up questions could be asked to better understand and contextualise each response. The researcher referred to Mack et al (2005) as a guide for these sessions.

3.6 Choice Experiments

The choice experiments were designed using the JMP 8.0 statistical software package from the SAS Institute. The package was chosen because of easy access to the software in the field and the Design of Experiments (DoE) module for the efficient design of choice experiments. Five attributes were chosen (Table 3.1). Hensher et al., (2001) suggested using 16 choice sets, but because of difficulty administering longer choice sets and respondent fatigue, it was decided to use 2 different surveys each with 8 choice sets, yielding a total of 16 different choice sets. According to Huber and Zwerina (1996), specifying nonzero prior estimates for the mean and variance of the attributes estimated by the multinomial logit model leads to a more efficient design. Priors would normally be obtained via a pre-test of the choice experiment, but due to sampling difficulties and the small population size, a pre-test was not carried out. However, priors were estimated based on knowledge of water use from interviews and from past work, such that a unit (+1) increase in utility was assumed as the levels of each attribute increases from left to right in Table 3.1. Hence, for example under the "Quality" attribute, "Treated" was assumed to have a higher utility than "Not Treated" by one unit, and so on. Furthermore, a uniform variance of 1 was assumed for each attribute. This was done because according to Huber and Zwerina (1996), specifying any priors, even if they are misspecified, increases the efficiency of the experimental design. Hence, the DoE module developed an experimental design that satisfied the orthogonality and efficiency constraints.

Table 3.1 Summary of attributes and levels in choice experiment design				
ATTRIBUTE	**LEVEL**			
Quality	Not treated	Treated		
Pressure	Low	High		
Reliability	Flows sometimes, but know when it flows	Always flows		
Level of service	Stand tap	Private connection		
Price per household per month	0 CFA	500 CFA	1000 CFA	5000 CFA

Table 3.1 Summary of attributes in Choice Experiment

3.6.1 Explanation of attributes

Water quality is a binary variable, because in the context of water supply in Buea, water is either treated or untreated. It is believed that utility derived from the service will increase with water treatment. Willingness to pay for water treatment will give a qualitative reflection of public perception of the natural quality of the scheme's water source.

Pressure was chosen because of previous studies where pressure was identified as a factor affecting consumption, since it influences the time to collect water. A binary choice was assigned based on responses to previous surveys.

Level of service was chosen because previous studies indicated convenience/distance was a factor affecting consumption. The manual published by WELL (1998) found that reducing trip time (and distance) to the water source increases per capita water consumption, and Meaney (2008) noted that distance to source was an important issue to consider for standpipe users in Buea. In-house and yard connections were grouped

together because in the GWM scheme, they are both synonymous with private connection.

Reliability was chosen because from previous work it was highlighted as the most important issue in water supply. Meaney (2008) found that of water users in Buea, the largest cohort identified reliability as the aspect of water supply requiring immediate improvement. It was simplified into two options: rationed flow with certainty of flow, or constant flow of water.

The different monthly prices were chosen to give options of free water (0 CFA), a nominal charge per household to access water from standpipes (500 CFA current rate for standpipes; about 1.10 CAD), the current rate for households (1,000 CFA for private connections; about 2.20 CAD), and the highest current price (5,000 CFA tariff for each hostel; about 10.60 CAD)[4]. In the GWM scheme, users are charged flat rates for water use because the system was built without water meters.

3.6.2 Analysis of the choice model

The output of the choice model in JMP 8.0 (see Appendix V) is a utility model fitted to the response data. The model estimates the coefficient for each attribute in the utility function. A p-value is also calculated for each attribute to evaluate the significance of the effect of each attribute on the utility model. Based on which p-values are significant, it can be inferred which attributes users find most important.

[4] Exchange rates obtained from www.xe.com/ucc

In addition, the software outputs marginal utilities for each attribute. The marginal utilities of price can be manipulated to obtain an average unit utility cost. For example, if the marginal utility of a price increase from 0 to 1,000 CFA is a difference of -0.5 units of utility, it can be estimated that the unit utility cost is 2,000 CFA per unit of utility. Then this unit utility cost can be multiplied by the marginal utilities of the other water supply attributes to obtain implicit prices for each water supply attribute.

Subject effects can be examined by coupling the choice response data with subject data from the questionnaire. Thus, the interactions of gender, education, income, with choice preferences can be inferred.

4. Results and Discussion

This section presents and discusses the research findings. It is organised by theme, beginning with a chronicle of the development of the Great Soppo, Wokoko, Molyko (GWM) community water supply scheme until the present day, followed by thematic discussions of the issues facing the scheme, and ending with a discussion of the potential for financial self-sufficiency.

4.1 Results

4.1.1 Description and location of the GWM scheme in Buea

The GWM scheme was constructed in 2001 and 2002 (Figure 4.1). It harnesses a spring source in Great Soppo, and while houses in Great Soppo are not connected directly to the network, they benefit somewhat from having the source in their neighbourhood, from which water is collected directly (Appendix VI). The scheme was designed to serve the populations of Wokoko and Molyko that are located downhill of the urban core of the town (households clustered around the blue highlighted scheme are shown in Figure 4.1). Buea follows a linear settlement pattern, with development following the path of the main road (the red artery in Figure 4.1) leading up the lower slopes of Mount Cameroon towards Upper Farm and Buea Town. The villages of Wokoko and Molyko used to be more sparsely populated and distinct from urban Buea, which is located around the higher elevations of the main road. Today, due to the growth of the town, Wokoko and Molyko are peri-urban neighbourhoods or suburbs of the urban Buea area, but they still have some characteristics of rural areas such as poor road, electricity, and water supply infrastructure. When originally conceived, the GWM scheme supplied the villages of

Wokoko and Molyko which had few inhabitants and households, through stand taps only. After the opening of the University of Buea, Buea underwent a boom, and many incoming students sought accommodation in the new private hostels and multi-family residences that were being built where there was space, in the sparsely inhabited areas of Wokoko and Molyko. This placed stress on the network and the management committee began to connect individual houses to the network. The pipes for the distribution network extend as far down as the University of Buea in Molyko, but today only Wokoko (Ndongo) is served with water (Figure 4.2), as only one branch of the system is operational, despite the spring source having excess capacity that is not harnessed by the network.

Figure 4.1 Location of the GWM scheme (blue) in Buea

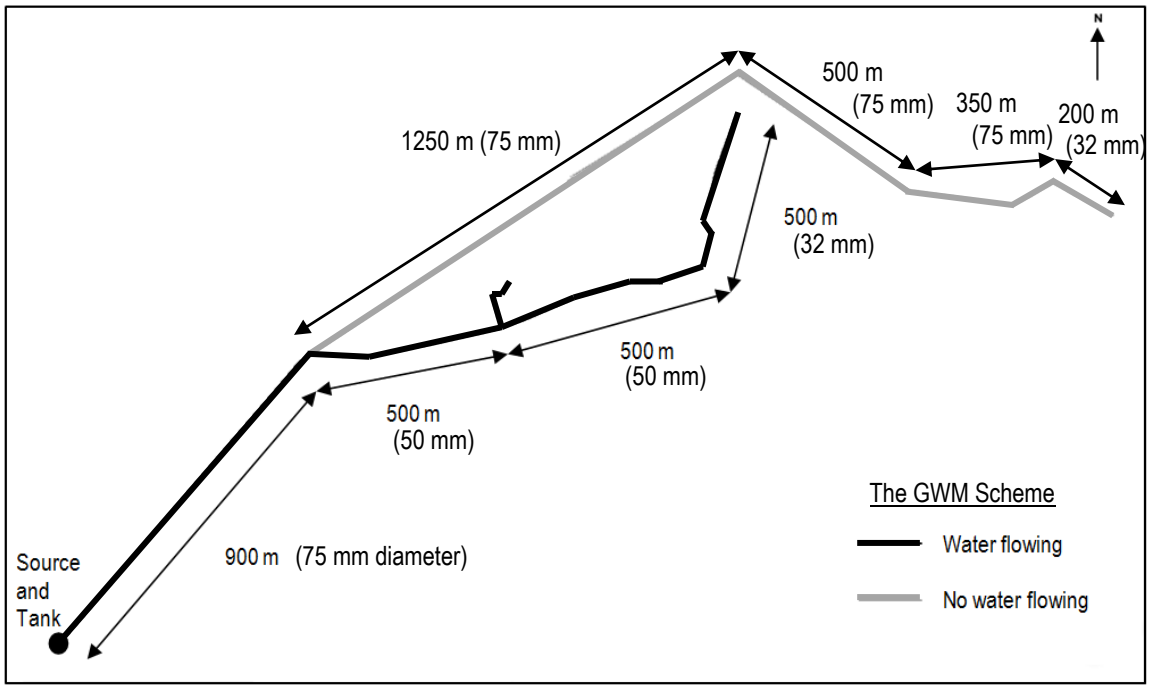

Figure 4.2 Dimensions of the GWM scheme

The GWM scheme is gravity fed and is mostly laid in uncleared bush. The pipe from the supply tank at the source runs 900 m before splitting in two, from which a 1500 m line runs through Ndongo and a 2300 m line runs down to University of Buea in Molyko. The elevations of the four stand taps are shown in Figure 4.3. The only functioning stand taps are in Ndongo (a neighbourhood of Wokoko) where the household sample was obtained. Molyko no longer receives water from the network because of the growth in demand and increase of private connections to the network, which was designed to supply public standpipes (a more detailed discussion follows in Section 4.2). Based on data obtained from the water management committee and the scheme's technician, and physical data that were collected, flow in the functioning part of the network (see Figure 4.2) was estimated using basic pipe-flow and fluid mechanics principles (Table 4.1, Appendix VI).

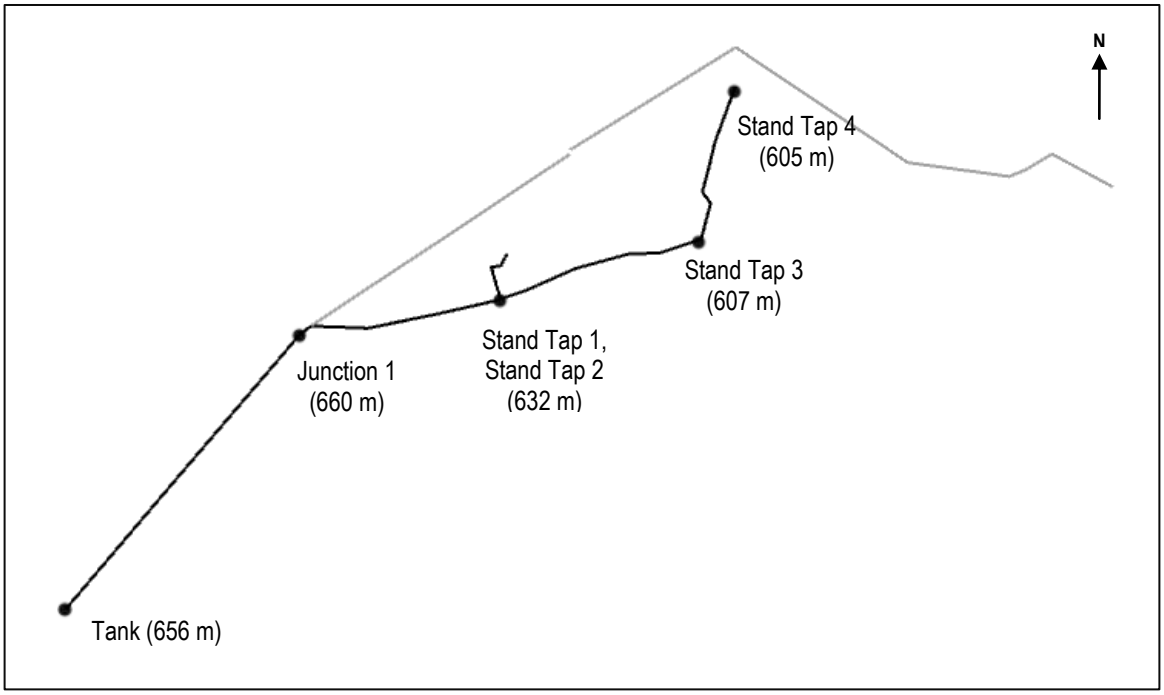

Figure 4.3 Elevations of selected points in the GWM scheme pipeline

Table 4.1 Estimated flow in the GWM scheme network (see Appendix VI for details)

Location:		Tank	Junction 1	Stand Taps 1, 2	Stand Tap 3	Stand Tap 4	Total
Elevation	(m)	656	660	632	607	605	
Available Head	(m)		-4	24	49	51	
Pipe Length	(m)	0	900	500	500	500	
Pipe Diameter	(mm)		75	50	50	32	
Discharge Q	(m^3/s)		2.45×10^{-3}	2.45×10^{-3}	1.23×10^{-3}	0.613×10^{-3}	
Total head loss h_{ftot}	(m)		4.71	23.77	28.54	38.71	
Total daily discharge (assuming 8 hour collection time per day)	(m^3/day)			35.3	17.6	17.6	**70.6**
Population potential capacity	(50 litres/pers/day)			706 pers	353 pers	353 pers	**1,411 pers**
	(20 litres/pers/day)			1,764 pers	882 pers	882 pers	**3,528 pers**

Table 4.1 Flow in the GWM scheme network

The maximum possible flow rates in the supply pipes are 2.5 l/s from the supply tank to Stand Taps 1 and 2, 1.2 l/s between Standtaps 1 and 2 and Standtap 3, and 0.6 l/s between Stand Tap 3 and Stand Tap 4 (constrained by the available head, pipe diameter, and pipe roughness). The total possible discharge is 70 m^3/d, which could supply 1,411 people at a consumption rate of 50 litres/person/day. The distribution of this supply is that 700 people could be supplied from Stand Taps 1 and 2, and 353 people could be supplied from each of Stand Tap 3 and Stand Tap 4. These estimates are based on the assumption that demand at the stand taps and from private connections along the network are uniform and uniformly distributed. Available discharge is based on pipe constraints (either available head or flow from previous segments). Total daily discharge and population potential capacity are based on assumptions of 50 litres/person/day consumption and that water is collected continuously from stand taps for eight hours per day (note that if collection time is decreased to 4 hours of continuous collection at all points, the population potential capacity halves to 705 people). Similarly, if per capita consumption is increased beyond 50 litres/person/day (as is likely to be the case for consumers with private connections) then the population potential capacity also decreases.

The flow rate after Stand Taps 1 and 2 (in pipe sections 3 and 4) is not limited by pipe size and available head (since total head loss is less than available head in the part of the network between Stand Taps 1 and 2 and Stand Tap 4 (Table 4.1)), but by the discharge in the sections between the supply tank and Stand Taps 1 and 2. Hence, if the size of the supply pipes between Junction 1 and Stand Tap 1 and 2 were increased from 50 mm to 75 mm, total head loss would decrease and flow rate could increase. The potential capacity

of the network at 50 litres/person/day consumption could increase to 1,736 people (Appendix VI for calculations).

According to the water management committee and technician, when it does not rain heavily, the flow from the source reduces somewhat. This happened notably once since the scheme opened, in 2003. There was water in the tank and pipes, but the tank was not as full as it usually is. Information indicates that the spring probably originates at higher elevations of Mount Cameroon, driven by rainfall and runoff that infiltrates to groundwater and flows overland and through underground fractures characteristic of the volcano. It is unknown whether climate change, or even anthropogenic activity around the upper slopes of Mount Cameroon which recharge the spring will begin to impact the capacity of the spring source. Without more detailed knowledge of the spring's capacity, hydrogeology and recharge rate, this is unknown. Sometimes it rains very heavily, and the combination of hilly topography and high runoff results in mass movements of earth and mud, which can be dangerous for inhabitants of the area, and also has an effect on the water quality of the spring source, with increased suspended material and debris from runoff after heavy rain.

According to the scheme's technician, the spring continues to flow in the dry season with little or no change in flow. If the committee had the financial means, they would employ more workers to schedule water to different parts of the network to enable adequate water pressure when demand exceeds supply. They would also increase the capacity of their network by harnessing more water from the spring, by increasing the size of intake pipes,

building a larger tank and a second reservoir downstream of the first to increase the flow rate in the network (thereby maintaining pressure) and improve the resilience of the system to any fluctuations in flow. However, the network calculations show that the most pressing constraint on the water supply is the diameter of the pipes given the available head. A possible interim solution would be to have storage tanks at each stand tap that would fill continuously from the tap. However, water quality problems due to the standing water may preclude this as a workable solution.

An estimate of the spring's current capacity was attempted, but due to difficulties associated with the terrain and sources of error, only an estimation of the flow was obtained, at 3.5 m^3 / min or 5,000 m^3 / day with an estimated margin of error of 50% (Appendix VI). By comparison, the current combined capacity of SNEC/CDE's springs is about 6,500 m^3 / day. As mentioned earlier, the GWM scheme's source has large excess capacity. At present only a fraction of the spring is harnessed for the network.

4.1.2 Demographics and the role of women in water in Buea

This section describes characteristics of community water users from the household questionnaires (Appendix IV). First, a brief mention must be made about the gender implications of water use, not only in Buea, but in many Sub-Saharan developing countries. It became quickly evident from personal observations and informal conversations with people in Buea that in most households women are the main actors responsible for water management. In some instances, even when a male member of the household was asked a question about water, he would refer to a woman from the

household for an answer. This is in accordance with the literature detailing the important role women play in water use and management and the importance of involving women in water management and planning activities (Chipeta 2009; Whittington et al 2009; Faysse 2006). Except in special cases of single person households or hostel residents, which comprised 34% of the surveyed cases, women are responsible for providing water for the family unit and managing the water in the surveyed households. The questionnaire tried to capture women's views; of the 46 respondents, 58% were female, 42% were male. The household questionnaires were administered in the late afternoon, when predominantly women were at home, going about their business preparing for the evening dinner and doing other household chores. The socio-economic profile of questionnaire respondents is summarized in Table 4.2.

Table 4.2 Socio-economic profile of questionnaire respondents	
Total number of households sampled	46
Proportion of female respondents	58 %
Proportion of hostels in sample	34 %
Highest Education Level Attained	
Less than high school	17 %
High school	24.4 %
University	58.5 %
Household Monthly Income (1 CAD ≅ 470 CFA)	
No response	45 %
Less than 100,000 CFA /month	30 %
100,000-250,000 CFA/month	22.5 %
More than 250,000 CFA/month	2.5 %
Median household size	7 persons
Median hostel unit household size	2 persons

Table 4.2 Socio-economic profile of respondents

Thirty four percent of questionnaire respondents were hostel residents, and care was taken to sample a range of hostels, never taking more than two residents from the same

hostel. Therefore, the Figure of 34 % is not reflective of the proportion of hostel residents among the users of community water, but is more a reflection of the proportion of hostels among all the buildings that use community water. The proportion of hostel residents among community water users was not able to be estimated, but it is believed to be greater than 34 % because each hostel is estimated to house between 10 to 30 residents, which is greater than the median household size of around seven people. The median household size is consistent with findings from household surveys administered in previous research (Meaney 2008). In contrast, each unit in a hostel had a median number of residents of two people, and personal observations suggested that hostels in the neighbourhood comprised of between five and fifteen units each.

The large proportion of university-educated respondents is a phenomenon influenced by Buea's position as a university town, both because of a large number of students and because of a large number of alumni. Nearly half of respondents chose not to reveal their income category, but those who did paint a picture of a large number of lower to middle income households and students with little income. A small proportion (2.5 %) earn over 250,000 CFA/month[5], which was chosen as the highest income category based on previous research in Buea (Meaney 2008).

4.1.3 Characteristics of community water use

Table 4.3 summarises the characteristics of community water use in the GWM scheme. The survey results indicate that community water's role is to provide an alternative to

[5] Equivalent to about 530 CAD/month in 2011

CDE/SNEC water, mainly because it is not available in most of the neighbourhood (56 %). Community water is also a lower cost and a more convenient alternative to CDE/SNEC water: if users wish to use CDE/SNEC water, they must fetch water from public taps at least 20 minutes away, and some hostel owners opt for community water instead of CDE/SNEC water because of lower monthly costs. Twelve percent of respondents chose community water because of better reliability and lower cost respectively. These findings are supported by previous research from Buea that indicated that community water tends to be more reliable than SNEC/CDE water and also costs less. Few chose community water because of a perception of better water quality (5 %) also supporting previous findings that community water tends to be of inferior water quality than SNEC/CDE water. Another notable finding is that five percent of respondents stated that community water was used because it was the landlord's choice, giving an approximate indication of the number of sampled hostels that have private connections to community water. Above all, it is clear that community water is filling the service gap from the lack of provision by SNEC/CDE water.

Just over half (51 %) of GWM scheme users never pay for water, while 40 % have never been contacted by the management committee about paying for water. Most users pay what they can as opposed to a flat rate or set tariff (70%); whenever money is needed they contribute to their means. Households who contribute pay a median monthly rate of 917 CFA, close to the intended tariff for households. The tariffs were designed to charge student hostels 5,000 CFA/month, households with private connections 1,000 CFA/month, and households who use stand taps 500 CFA/month. There is a connection

fee for private connections of about 180,000 CFA that can be negotiated down to 150,000 CFA depending on the individual household's ability to pay, on top of which the household pays for material and labour costs for the connection.

Table 4.3 Characteristics of community water use for the GWM scheme	
Proportion of surveyed respondents using	
Stand taps	55 %
Private connections	45 %
Most important reason why community water is used	
Landlord's choice	5 %
Better water quality	5 %
Better reliability	12 %
No SNEC/CDE water in this area	56 %
Shorter distance	10 %
Lower cost	12 %
Payment	
Proportion of users who have been contacted about payment	40 %
Proportion of users who do not pay for community water	51 %
Proportion of users who only contribute to their means	70 %
Current median monthly payment (1 CAD ≅ 470 CFA)	917 CFA
Mean monthly willingness to pay for current service	
Total sample	950 CFA
Private connections	1,680 CFA
Stand tap users	395 CFA

Table 4.3 Characteristics of community water use for GWM scheme

The survey also characterised willingness to pay for the current level of service of community water. Households with private connections are willing to pay a mean rate up to 1,680 CFA, while stand tap users are only willing to pay a mean rate up to 395 CFA. It appears that there is a basis for adjusting the current rates, since stand tap users feel that they are paying too much while users with private connections are willing to pay more. At the current tariffs, stand tap users are effectively subsidizing the rates of private users,

which undermines the management committee's attempts to make standtaps accessible to marginalised users such as the poor and the elderly.

As Table 4.3 suggests, the enforcement of fee payment is difficult; when users refuse to pay, they are disconnected until they decide to pay, using the several stopcocks at various locations throughout the network. But many people turn to the community standpipes, which *de facto* are free of charge because of the management committee's difficulties with controlling who uses the taps.

4.1.4 Key findings

- Rapid population growth exceeded the projections, placing stress on standpipe infrastructure.
- Deterioration of service resulted in the use of alternative water sources, including a return to the use of "unimproved" sources.
- Poor planning resulted in loss of flow to parts of the network.
- Action needs to be taken to improve participation and to uphold the participatory mechanisms as originally intended.
- Water treatment and price are the most important attributes to users.

The key findings summarised above will be discussed in the following sections. Many of the findings relate to the fact that the Great Soppo, Wokoko, Molyko (GWM) community scheme continues to function in a rapidly urbanising context. The following sections will discuss in more detail how the problems arose, the implications of these water supply

problems, why the management committee was ineffective in dealing with the problems, the breakdown of the participatory mechanism of the community scheme, and the results of choice modelling experiments conducted on community water users.

4.2 A discussion of the problem

4.2.1 The context: about the GWM scheme

Approximately 80 paying households are on the management committee's books, in addition to which many users of community water are students in student hostels. The questionnaire sampled 46 households including students; 34 percent of the sampled respondents lived in student hostels, and observations sometimes indicated more than one person living in a single occupancy hostel. The remaining 66 percent of respondents were households. Forty five percent of the sample accessed community water through an individual connection, while 55 percent accessed water through a community stand tap. According to the water management committee of the GWM scheme, the distribution network was originally intended to supply only a standpipe level of service, but over time, the growth in the number of students placed high pressures on the standpipe infrastructure, resulting in long queues and deterioration of service. In response to this, the water management committee took action by offering private connections to the student hostels, thereby hoping to alleviate long queues and improve service from the public taps, which the more marginalised population including the poor and the elderly relied upon.

The problem can be put into context as follows. Given a median household size of 7 persons, the population of paying consumers on the management committee's books (predominantly those with private connections) is 560 persons. Added to that number is an unknown number of non-paying stand tap users who are not accounted for in the management committee's records, and an estimate of between 750 and 1200 students housed in hostels around the neighbourhood. Since the system's current population potential capacity was estimated at 1400 persons (Section 4.1.1), this highlights that the system is operating at or close to capacity with very small margins for error.

4.2.2 Understanding users' "satisfaction"

The construction of the GWM scheme has undoubtedly improved the lives of residents of Wokoko and Molyko. Where previously people had to rely on distant public stand taps run by the national water utility SNEC/CDE or on unsafe traditional sources such as open watercourses, after construction people had access to stand taps within a few minutes from their homes supplying water from a more protected source upstream. Furthermore, as rural areas that were quickly being subsumed by urbanisation into greater Buea, the villages were faced with increasing population and population density which placed more pressure on traditional sources of water and increased the risks of contamination, thus a piped water distribution system would provide improvements in access and water quality. It is clear, then, that community water users in Wokoko and Molyko have benefited from the GWM scheme, and indeed, 60 percent of questionnaire respondents indicated that they were satisfied with community water. This leads to the question: which factors might be related to consumer satisfaction? Going beyond the obvious physical factors

such as level of service, pressure, flow, etc., a large majority (82 %) of households who described themselves as having a "sense of ownership" over the community scheme also reported being satisfied with the scheme. Additionally, a majority (64 %) of satisfied households reported also having a "sense of ownership" while the majority (75%) of unsatisfied households also described themselves having a "sense of ownership," (see Table 4.4).

Table 4.4 Contingency table of user satisfaction against sense of ownership (NOTE: N=number of respondents; Compare **bold percentages** down respective columns; compare *italicised percentages* across respective rows)

	Are users satisfied?				
			No	Yes	TOTAL for sense of ownership
Do users feel a "sense of ownership?"	No	Total % (N)	27 % (6)	23 % (5)	50 % (11)
		Given satisfaction, sense of ownership felt?	**75.0 %**	**36 %**	
		Given sense of ownership, satisfied?	*55 %*	*45 %*	
	Yes	Total % (N)	9 % (2)	41 % (9)	50 % (11)
		Given satisfaction, sense of ownership felt?	**25 %**	**64 %**	
		Given sense of ownership, satisfied?	*18 %*	*82 %*	
	TOTAL for satisfaction		36 % (8)	64 % (14)	22 respondents answered both questions

Table 4.4 Contingency table of user satisfaction and sense of ownership

"Sense of ownership" is a concept that is revisited a number of times in the community management literature; it is seen as an important condition for sustainability, affecting satisfaction and willingness to pay. Also, effective participation will contribute to a

perception of ownership and responsibility (Carter 1999; Evans 1992; Njoh 2002). However, Harvey and Reed (2007) and Bakker (2008) cautioned that while ownership can contribute to sustainability it must not be made a goal in itself. Indeed, the findings from Table 4.1 above are not strong enough to indicate causation, but suggest a weakly significant (P-value = 0.0913) relationship that sense of ownership is associated with positive satisfaction. The relationship is not statistically significant at the significance level of 0.05 (five percent) nor 0.01 (one percent) that are used in most engineering applications but is significant at a significance level of 0.1 (ten percent). Hence there is a 90 % chance that the results are not due to coincidence. More data might help to improve the significance of the relationship.

4.2.3 The extent of the problems: all is not well

However, the finding that a slight majority of households are satisfied does not mean that there are no problems with the operational and long-term sustainability of the GWM scheme. Unfortunately, virtually all households (98 %) reported experiencing irregularity of flow. Furthermore, when asked about the characteristics of the no flow periods, all respondents responded with uncertainty, using adjectives such as “sometimes,” “not sure,” “about,” “random,” highlighting the difficulty users have when coping with the water supply.

Similarly, there was a wide range of responses about the duration of no-flow periods. Only one household reported an “insignificant” duration of “five hours per month” and another household reported going a day at a time without water, while the bulk of households reported facing between two to seven consecutive days without water every

year. More alarmingly, several households reported going one or more consecutive months without receiving water every year.

There was more of a consensus about the time of year when water shortages are experienced. The majority of responses highlighted the November to March period, which are the months directly preceding (November), during (December to February), and directly after (March) the dry season. This pattern might be expected, since the dry season is the time of greatest water scarcity, especially in the months of December to February when there is little rainfall. However, the shortage of water in the GWM scheme's pipes was not due to lack of water at the source, since in fact the source always flows. Research showed that these failures are in fact due to broken pipes as a result of vandalism. Further research found that vandalism increased during the dry season because of the shortage of water and scarcity of alternative sources. The GWM scheme, which was identified in Section 4.1 as possibly being close to capacity, may not be able to deliver the increased demand for community water during the dry season. As a result, because water is not supplied to their part of the scheme, some opportunistic people searching for water find exposed sections of the network's PVC pipes that do receive water and break them to obtain water directly. The management committee finds it difficult to identify vandals and to take preventative action.

Interestingly, another pattern was that some households reported experiencing shortages during the wet season months of June to August. Further investigation of this issue found the cause during these months to be more frequent pipe blockages because of higher

sediment load from the increased runoff and biological debris from increased plant growth.

4.2.4 Implications: the gravity of the problems

Water is a necessity for human survival and development, so when faced with shortages from one water source, people will cope by finding other sources. This might manifest itself as an increase in the burden of fetching water as users travel longer distances and spend more time fetching safe water. For others, shortages may result in potential health pitfalls as people fetch water from closer, more convenient, yet potentially more dangerous unprotected sources. It was shown earlier that virtually all users of the GWM scheme reported experiencing irregular flow. Eighty percent of households practice rainwater harvesting to supplement or substitute for community water (Figure 4.4). The rainwater harvesting is relatively informal: households leave containers of varying sizes outside to collect precipitation directly or via a gutter. The two most common volumes of rainwater collected per rainfall event as the container is emptied are 15 and 200 litres (Figure 4.5). The 15 litre size corresponds to widely available plastic buckets while the 200 litre size corresponds to large barrels that some households have in their gardens. The smaller containers would be emptied into separate storage containers and then replaced outdoors in order to allow for continuous collecting of water during a rainfall event, while the larger containers would usually be filled once and kept as storage. However, the median volume of 25 litres indicates a tendency to collect smaller volumes of rainwater as needed (Table 4.4 and Figure 4.5). This makes sense for most of the year, when rainfall is fairly abundant, but historical records show that during the dry season months

of December to February when the community water shortages are also most acute, there is little to no precipitation (Figure 4.6). Hence, users cannot rely on rainwater year-round, and most are not equipped for large-scale rainwater collection and storage that would be needed to make up for the absolute lack of precipitation during the dry season.

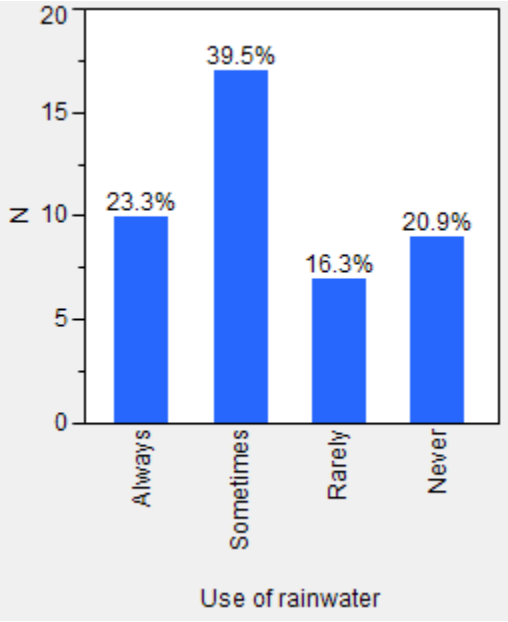

Figure 4.4 Prevalence of rainwater harvesting in the GWM scheme

Table 4.5 Volume of rainwater collected by community water users	
Statistic	Value (litres)
Mean	72.5
Std. Dev.	81.8
Median	25.0
Mode	15.0

Table 4.5 Mean, median and mode of volume of rainwater collected per rainfall event

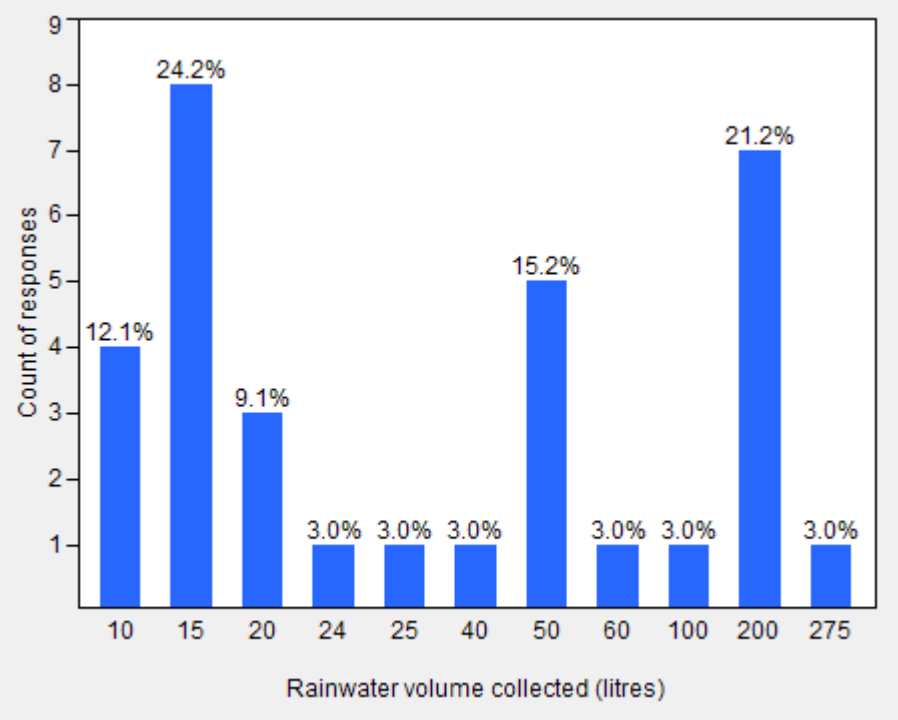

Figure 4.5 Bar chart of distribution of rainwater volume (litres) collected per rainfall event by community water users

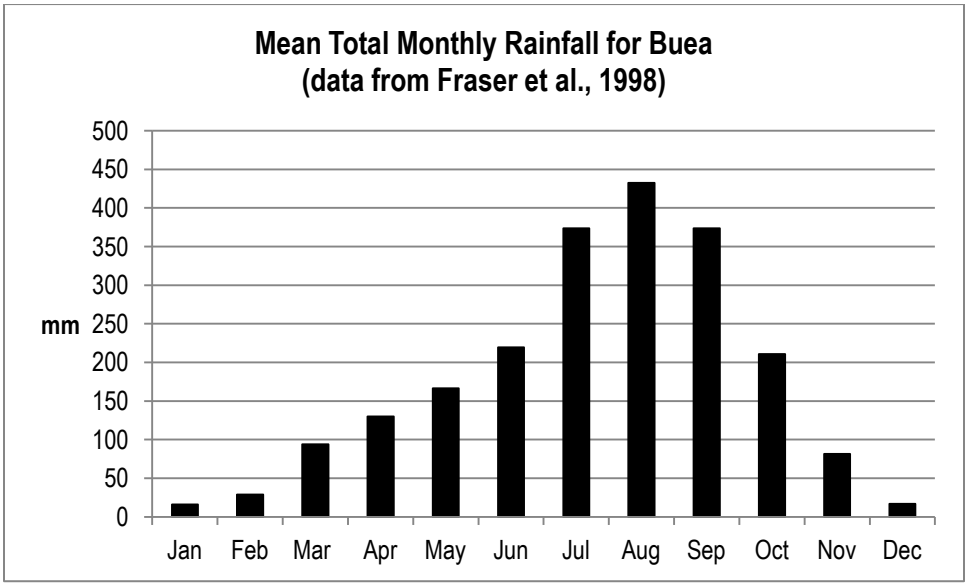

Figure 4.6 Chart of mean total monthly rainfall in Buea

Therefore, community water shortages mean that a majority of users (88 %) must also rely on sources other than community water or rainwater. The most popular sources included an open stream running through Wokoko, and a protected spring located half an hour away. Eleven households recognized the health hazards of consuming water from an unprotected source and only used the stream for nonpotable uses, however five households use the stream for all household uses including for drinking. This reflects a more general notion observed among many residents of Buea that the untreated water from springs and streams is safe to drink, but this notion is changing because of more research like that of Akoh (2009) showing that water quality in Buea is deteriorating.

4.3 The underlying causes

4.3.1 Unsustainable development due to poor planning

One of the contributing factors to the problems the GWM scheme is facing today is rooted in deficiencies of the initial plan. The annual growth in student population in the whole of Buea, estimated by the water management committee at around 1000-3000 new students for each year the scheme was in existence, was not accounted for in the planning of the system, despite the University of Buea already being in existence for several years before the GWM scheme was planned. Furthermore, the decision to make water available through individual connections to hostels was not ideal without knowing the capacity of the network. So, besides the inability of the physical network to cope with the unanticipated increase in connections, it appears also that the management committee was unable to adapt to the demographic changes, which will be discussed in Section 4.4.

Unfortunately, this deficiency of planning appears to be somewhat symptomatic as it has been observed in another nearby community scheme (Great Soppo-Bonduma Community Water Supply) that is currently in the planning phase with a partnership between the community and an NGO. Although the proposal for the GWM scheme could not be obtained, the proposal for the Great Soppo-Bonduma community water supply project illustrates the poor planning, lack of detail, and neglect of some technical aspects that plagued the GWM scheme.

Great Soppo-Bonduma Proposal

While the Great Soppo-Bonduma proposal included an estimate of population to be served, the choice of design population was not backed by a population growth rate or other justification. The population is currently at 25,000 and estimated to increase to 40,000 inhabitants in 20 years. However it was not discussed what proportion of the 25,000 already have access to water from SNEC/CDE, and how many will actually use community water, nor how the 40,000 figure was arrived at. Unfortunately, population projections are difficult to make when demographic and population data are lacking as is the case in many developing areas experiencing rapid growth, however participatory methods can be used to obtain local knowledge and historical experience to counter this uncertainty. For example, a quick compilation of the University of Buea admissions for the 2010 academic year shows an intake of 6000 students[6], many of whom come from outside of Buea and stay in the town after graduating, indicating the scale of the growth

[6] Data sourced from University of Buea website (http://ubuea.net/index.php?option=com_content&view=category&id=3993&Itemid=195) and compiled by author.

of the student body and giving an idea of the demographic pressures on Buea. The University could play a larger role in the community by sharing its knowledge of student demographics with project planners.

Another section of the proposal called for pumping stations, which appears to disregard local difficulties related to power supply and technical capacity. Pumping requires more technical capacity for operation and maintenance, requiring a skilled full-time technician, and most importantly, observations showed that pumping would be subject to a fluctuating and erratic power supply. No justification was made for proposing this more expensive option, nor was there a discussion of the costs and benefits of pumping compared to a gravity-fed network, which is also feasible given the elevations of the source and the community served. Should the proposal go through, the project would risk running into an operational failure.

Finally, the proposal made a provision for training of a "maintenance committee," charged with administering the project at all levels, collecting funds and levies from the community for maintenance. Although community participation is evident in the conception of this project, where it was a "self-felt need" for the community, and the maintenance committee is also designed to be participatory in nature and elected by village assembly, there is no mention of continued monitoring and evaluation of these mechanisms after project completion. This is not to say that the project should not be realised; on the contrary, the social developmental benefits of the water supply project are obvious. However, the proposal should have outlined a role for the partner NGO to return

to the project and ensure sustainability of not only the physical infrastructure, but also of the management committee and participatory mechanisms.

It could be argued that giving the local partner NGO the role in post-construction monitoring and evaluation is unfair due to limited resources. However, post-construction support (in the form of access to spare parts and technical expertise) has been shown to improve the sustainability of community managed rural water supply (Whittington et al. 2009). Therefore, future community projects should only be undertaken where adequate resources to ensure post-construction support, including monitoring and evaluation of technical and managerial aspects can be assured.

The Great Soppo-Bonduma project illustrates the short-sighted planning that also plagued some aspects of the GWM scheme. It is important to address the deficient planning that is evident in some community-managed schemes in order to avoid time delays, cost overruns, unrealistic expectations, and unsustainable projects, all of which erode the community's support for the project (Njoh 2003b) and may lead to project failure. Furthermore, as was shown to be the case in the GWM scheme, deficient planning also undermines the intended developmental goal of eliminating dependence on "unimproved" water sources, which users return to rely upon even for potable uses such as drinking and cooking.

4.3.2 Ineffective management and insufficient capacity

The problems faced by the GWM scheme are also attributable to the management decisions taken after the community water supply project was planned and constructed. For example, the decision taken by the management committee to connect individual households to the network, while alleviating queues at standpipes, had a detrimental effect to the overall level of service. According to the technician of the GWM scheme, the many individual connections to hostels and households reduced pressure and flow in the entire network, and due to the linear nature of the network resulted in the extremes losing service completely. The network was originally intended only to supply standpipes, and not intended to supply individual households, which would have affected the design of the network. Connecting individual households, in particular those multi-level hostels and residences that require higher water pressure, to the network had a detrimental effect on the pressure in the pipes due to increased demand. Gleick (1996) suggested that as distance to source decreases, water consumption increases. Easier access encourages more water use. Therefore, it is likely that after connecting individual households to the network, water consumption by those households increased, placing a strain on the flow available in the distribution network that was designed to supply the lower flow rate required by the standpipe level of service. In hindsight it would appear that as a strategy to alleviate long queues, connecting several individual households to the network was a poorer choice than extending supply to a few more key standpipes.

Therefore, unfortunately, it appears that the management decision to connect individual households was taken quickly and without fully understanding the implications since

understandably, urgent action was needed due to the overcrowding at the taps. Past studies of standpipe use in Buea found that daily water consumption was 21 litres per person (Sally et al., 2009). According to Gleick (1996) the minimum daily water requirement is 50 litres per person per day, and with improved access households may have increased their per capita daily water consumption towards the 50 litres mark, which places an increased strain on the supply in the network. The management committee had to act by itself, without recourse to seeking technical support or advice from the original technical partners (Helvetas Cameroon and the local NGO OSRI, see Section 1.4).

The issues above raise the question of how prevalent the problem of lack of planning and lack of technical capacity is for small community water management committees in this region, and raises questions about the sustainability of the new community-managed schemes that are being built today with the support of local and international NGOs. As noted by Spencer et al (2008) and Anand (2006) community-managed projects are an important contribution to meeting MDG Target 7C, and it is imperative to take steps to ensure that these projects continue to function as intended. The NGO OSRI does not have a local presence in Buea; its offices are located in the city of Kumba, which is a two-hour drive away. Ongoing technical support from NGO's that are involved in community-managed projects has been cited as an important factor in their success. The technical capacity required to inform management decisions is not present in Buea. Personal observations indicated that the sole employee of the municipal council with technical skills is no longer active on the management community of the scheme due to other commitments. The next section examines the main cause of the reduced effectiveness in

the management of the community scheme: the breakdown of participation. This compounded the physical deficiencies of the network.

4.4 The breakdown of participation and of the management committee

There is a distinction in the literature between the "hard-path" and the "soft-path" with respect to solutions to global water problems (Gleick 2003). The world of water resources development, management, and use is transitioning from traditional "hard" solutions including the construction of massive infrastructure, to "soft" solutions that complement the physical infrastructure projects with small-scale solutions and management solutions. Effectively, there is a growing understanding that many of the world's water resources problems are not an issue of quantity, but rather that the quality of management is often the limiting factor. In this spirit, this section examines the problems of the GWM scheme in the context of its failed management structure.

Helvetas Cameroon designed its community-managed schemes to be participatory by nature, by trying to involve both men and women and all demographics, by establishing a community sense of ownership, and by encouraging open and democratic planning of use (Leermakers 2000). Unfortunately, through a series of events related specifically to the urban context in which the GWM scheme was functioning, the participatory mechanisms that were designed and intended to be implemented broke down. The management committee became less effective at directly representing the interests of the community being served. Consequently, the atmosphere of non-participation can be related to operational difficulties experienced by the management committee, such as non-payment

of user fees and poor cost recovery. Non-participation also effectively crippled the functionality of the management committee rendering it less effective in responding to the scheme's problems. For example, currently the only remaining active member of the management committee is the chairperson. It was brought to light that the other appointed management committee members stopped attending meetings because some had left Buea, and others had "developed cold feet." The following sections will show that the urban context can explain some of the failure of the participatory model.

4.4.1 The "indigene" and "stranger" dynamic

The interviews with community water users and with the chairperson of the management committee suggested that the "indigene" and "stranger" dynamic was an important issue contributing to the failure of participation. Urbanisation results in large influxes of people from regions outside a growing town, which often results in the mixing of different ethnic groups and makes community mobilisation difficult. Indeed, Sun et al (2010) found that in Ghana, communities that have higher levels of existing community groups tend to also have functioning water and sanitation committees. Ethnically diverse communities are less likely to have these types of community organisations.

Due to the growth in population and migration to Buea, an ever larger proportion of the residents in Wokoko and Molyko and consequently the users of the GWM scheme water, were "strangers" who did not belong to the indigenous tribe of the Buea area. The management committee, having been appointed by the municipal authorities (with no mechanism to change their membership), lacked the authority to adapt to these

demographic changes for two reasons. First, the municipal authorities' perception was that involving "strangers" from the community on the management committee might imply ceding control of the water that belongs to the local people. Second, the management committee itself was unable to adapt to the changes and seek new members because the sole authority to appoint people to the committee resided with the mayor. Hence, the management committee remained composed of members who were appointed from outside the community being served, not necessarily resident or users of the community water themselves. Instead, the research found that purported members of the management committee include some local municipal council members, and other prominent inhabitants of Buea, who were appointed on the basis of their competence and merits *only* without ensuring that they actually had a stake in the GWM scheme. As it happened, many original members of the committee left Buea. The municipality, in having appointed the original management committee, had the sole authority to allow the management committee to adapt to the changing demographics and become more participatory in its representation, but this did not happen.

In the intended operational structure designed by Helvetas, management committees and municipal authorities would be trained to create an enabling environment for participation of consumers in a "Demand Responsive Approach" to manage their systems (Helvetas 2002). However, in reality the management committee did not understand the importance of community participation and consequently did not petition the municipal authority to make changes, and no action was taken to petition for changes to the committee until after this research was carried out. Additionally, the municipal authority was either

unaware of the breakdown of the management committee or did not prioritise a revamp of the management committee. This resulted in a management committee that was no longer representative of the whole community of users. There was no role for an entity or institution to verify the continued success of community participation. The GWM scheme falls under the municipal council's purview of community development, and as such the municipal council has a technical adviser who also advises community managed schemes in Buea. However, there should also be a role akin to a management adviser, who provides input beyond the technical aspects of operating community schemes and about the importance of, and how to ensure, community participation. Such a role, which could be fulfilled by an NGO, a trained council member, or a government institution, would be able to advise the municipal council and community management committees about the importance of participation and help to avoid the breakdown of participation described above and in the following sections.

4.4.2 Rapid population growth and the dynamic nature of urban population

Buea is undergoing a period of rapid population growth, especially in the neighbourhoods being served by the GWM scheme. This had two implications for the breakdown of participation in the management committee of the GWM scheme. First, the dynamic nature of the urban population was such that after some time, some members who were appointed to the original management committee no longer resided in the neighbourhood or even in Buea. Hence, the management committee dwindled somewhat in numbers as some of its original members left town without being replaced. The management committee did not have sufficient autonomy to be able to nominate replacements and

adapt to the changing demographics without the support of the municipal authority, which renders it ineffective to adapt quickly to change. As discussed in the previous section, on the one hand the management committee chairperson did not understand the importance of community participation so did not push hard for change, and on the other hand the municipal authority either was unaware that change was needed or did not prioritize an overhaul of the management committee. Thus, today the management committee consists of only one "active" member: the chairperson.

The second implication of rapid population growth and the dynamic nature of an urban population was that traditional forms of hierarchy including the neighbourhood leaders or "quarter heads" as they are called, though they still maintained their official relevance, practically speaking they found their jobs increasingly difficult to carry out, resulting in less community cohesion and making community mobilisation more difficult. The increased size, turnover of population and new inhabitants makes keeping track of the population of their quarters, and mobilising action as a community, more difficult. This is why the success of neighbourhood standpipe committees similar to the ones described in Northwest Cameroon by Njoh (2006) could not be replicated as effectively in Buea. In the town of Kumbo in the Northwest, community-managed water has successfully been implemented on a relatively large scale. However, the caveat is that the traditional hierarchy of the Fon or leader in the Northwest Region is still very strong, which makes it easier to mobilise people to manage a neighbourhood standpipe.

4.4.3 Reduction of the feedback systems of rural community-managed schemes

The third mechanism by which the urban context contributed to the breakdown of participation is the reduction of feedback systems present in rural community-managed schemes. The GWM scheme's management committee was plagued with non-attendance and non-participation on behalf of its members. In rural community-managed schemes, three mechanisms work as incentives encouraging the participation of management committee members because they are also resident in the communities being served. First, there is the positive reinforcement of vested interest. When committee members are resident in the communities that they are serving, they have a vested interest in participating in management decisions to ensure that the scheme operates successfully because they would be directly benefitting from the fruits of their management and participation. Second, there is a positive feedback system in the form of community recognition of committee members by their peers in the community. For example, Sun et al (2010) found that contrary to standard logic, regular competitive elections are not needed to make management committees more accountable—community recognition creates a stronger mechanism for accountability of the management committee. In effect, committee members are encouraged to participate effectively because of the recognition, gratitude, prestige, and social standing that successful management may bring, and that recognition encourages them to continue to perform well. Conversely, the third mechanism is a negative feedback system of community pressure. Committee members who are unsuccessfully carrying out their management roles are pressured by their community peers to perform better and when they are performing successfully, there is

less pressure on them. However, these mechanisms will break down if committee members are not resident in the communities they serve.

In the case of the GWM scheme, members were appointed to the management committee from outside the community being served, partly because of the "indigene-stranger" dynamic described in Section 4.4.1, and partly because the implications of appointing people from outside the community on the effectiveness of management were not evident to the municipal authorities at the time. Appointed members were competent municipal council members, the council's technical adviser, and some prominent inhabitants such as the chairperson himself, who is a former mayor of Buea and public servant, but it was not understood that in spite of the appointees' overall competence, community management would risk failure as a result of the breakdown of the feedback mechanisms discussed above.

4.4.4 The logistical burden of participating in urban communities

Finally, in urban areas, increased distances make it more expensive and time consuming for committee members, who may reside outside of the community being served, to commute to meetings. In the case of Buea, regularly commuting from one part of town to another by car or taxi can be time consuming and costly, so the logistical burden of attending meetings discourages participation. This point was raised by the chairperson of the management committee who highlighted that a lack of payment or honorarium for their "sacrifices," resulted in committee members defaulting. This issue obviously has to do with appointing management committee members who are non-residents of the served

community because otherwise they would have other incentives or feedbacks, discussed in the preceding sections, encouraging attendance. Yet this issue is also applicable to the general case of urban community-managed schemes that cover a large area or where meetings are held at a distant location. Larger distances between where committee members reside and where meetings are held, coupled with a lack of remuneration results in non-attendance at meetings, so appropriate incentives are required in these cases to ensure that members participate in management committee meetings. Similar to any design, building redundancy in the mechanisms to encourage participation is useful. This way, even if the non-financial incentives are not effective, economic incentives or honorariums still encourage participation and vice-versa.

Therefore, the research has shown that the urban context contributes to the breakdown of participation on the "soft," management side of the scheme. These "soft" problems compound the "hard" problems of the water supply infrastructure itself because they make the management committee less effective at responding to problems. De Filippis et al (2006) lament that community participation is sometimes perceived as a "magic variable" in much of the literature and it is applied blindly in the development world. However, the experiences from this research show that improved community participation can address some of the real problems facing urban community-managed water supply projects. For example, one of the problems cited by the management committee is the difficulty of maintenance because of frequent vandalism to the network. The management committee was unable to respond because it did not have the manpower or capacity to take action. Increased participation of the community on the management

committee could (1) encourage cohesive community action against the problem, (2) give the management committee the manpower needed to control the vandalism, (3) might also find the cause of the discontent and respond to it, or (4) by improving dialogue might explain the reason for the lack of service and show that vandalism will not improve the overall service. Another problem mentioned by the management committee was the difficulty of operation and maintenance because of a lack of funds and non-payment of user fees. However, it was clear from the research that users are reluctant to pay because they are not seeing improvements in water supply. Improved community participation in the management committee would encourage communication between users and the committee, allow the management committee to present what they are doing and the costs incurred, and thus let the community understand how their contributions are spent, increasing transparency, accountability, and contributing to cost recovery.

4.5 The next step: the potential for financial self-sufficiency and cost recovery

This section presents a brief analysis of community water users' preferences and willingness to pay in order to inform future decisions relating to cost recovery and financial self-sufficiency. Choice experiments were used to model community water users' preferences.

4.5.1 Barriers to payment

Evans (1992) described the factors influencing willingness to pay for water, which include both factors related to water supply attributes as well as factors related to the institutional environment and the users' confidence in the system (see Section 2.2). In the

case of the GWM scheme, while people were willing to pay for specific attributes of water supply, they were not willing to contribute funds to the management committee because they were not always aware of what they were paying fees for, and as suggested by survey responses, their lack of satisfaction was a barrier to payment of user fees. This lack of satisfaction was due to the deterioration of the service described in previous sections coupled with the lack of dialogue between the community and the committee. Therefore, the scheme entered into a vicious cycle in which the lack of satisfaction led to defaulting of payment because the committee did not communicate the reasons for the problems to the users, and because of the lack of funds, the management committee's position further deteriorated as did the scheme.

The GWM scheme set out tariffs for its community water after some consultation with the community. The main criterion was affordability, since it was felt that the role of community water in Buea is to provide an alternative source to those for whom SNEC/CDE water is neither accessible nor affordable. For example, initially the standpipe rate was 1,000 CFA per household per month but after complaints that it was not affordable, the GWM scheme decided to charge a flat monthly rate of 500 CFA per household for standpipe users, in addition to monthly rates of 1,000 CFA per household for private connections (as well as the one-off connection fee of 180,000 CFA) and 5,000 CFA per hostel (also subject to the same one-off connection fee). After some time, it was found that stand tap use was difficult to control; hence they stopped charging households who used stand taps. The rates are relatively low; in comparison, the monthly water bill

for a SNEC/CDE individually connected household ranges from 2,000 to 10,000 CFA[7] and above per month.

4.5.2 Users' satisfaction

Section 4.3.2 introduced the notion of the "sense of ownership" and how that was related to users' satisfaction. An aspect of this sense of ownership is the perception that community water is meeting that user's needs and expectations. The results from the choice experiment summarised in Table 4.6 and Section 4.6 will contribute to this understanding of what users want from community water. User satisfaction is derived from the following water supply attributes: treated water is very highly valued by community water users; constant flow of water and high pressure are also important. However, the premium on private connections versus stand tap connections is relatively low, suggesting that there are better ways for the management committee to add value to the water supply, and consequently warrant increased user fees, than by increasing private connections. Rather, it appears that users will derive the most satisfaction from having treated water, in which case conditions would be more amenable to cost recovery through user fees. Furthermore, the results highlight some significant differences between male and female preferences which are discussed in Section 4.6.1.

[7] Equivalent to about 4 to 21 CAD in 2011

Table 4.6 Results of the choice experiment—GWM scheme users' expectations	
Result	Details
Across the entire sample, treatment and price were the only attributes to significantly affect utility.	• Users prefer treatment over no treatment. • Users rank price in descending order of utility according to: 500 CFA/household/month; 1,000 CFA/household/month; 0 CFA/household/month; 5,000 CFA/household/month.
Implicit prices	• Treatment is valued at 8,200 CFA/month over no treatment • Constant flow is valued at 1,900 CFA/month over rationed, certain flow. • High pressure is valued at 1,200 CFA/month over low pressure. • Private connections are valued at 940 CFA/month over stand tap connections.
When stratified between gender groups, treatment, pressure, reliability, and price are significantly different between males and females.	• Female preferences (implicit prices of the preferred option over the alternative in brackets, CFA/household/month) o Prefer treatment over no treatment (4,400 CFA) o Prefer low pressure over high pressure (610 CFA) o Prefer interrupted flow with certainty, over constant flow (1,300 CFA) • Male preferences (implicit prices of the preferred option over the alternative in brackets, CFA/household/month) o Prefer treatment over no treatment (8,700 CFA) o Prefer high pressure over low pressure (3,200 CFA) o Prefer constant flow over rationed, certain flow (4,300 CFA)

Table 4.6 Results of the choice experiment

4.5.3 Disutility of gratis water

Community water users also ranked price in descending order of utility accordingly: 500 CFA; 1,000 CFA; 0 CFA; 5,000 CFA. The relationship among 500, 1,000, and 5,000 CFA is expected, users prefer to spend less on water. However, 0 CFA was ranked lower than both 500 and 1,000 CFA. Users did not prefer having gratis water to spending up to 1,000 CFA per month. This could be indicative of users' understanding of the implicit value of piped, distributed water service, and that providing such a service free of charge is unrealistic; hence respondents were biased away from the free choice. They may even

have been associating unpaid-for piped water with negative connotations. All this seems to suggest that piped community water has a nonzero economic value to users. Hence, in order to start cost recovery, it would appear that sensitization and education about the value of piped community water and why it is important to pay for it plays a less important role than simply assuring people that they will be guaranteed a reliable treated water service if they pay.

4.6 Meeting the needs of users and designing appropriate policy

4.6.1 Importance of inclusive participation of women

Returning to Table 4.6, across the entire sample, treatment and price were the only attributes that significantly affected users' utility. Therefore, the model suggests that users prefer treatment over no treatment. This behaviour is to be expected, since treatment adds value to a water supply system. However, it was surprising that of the water supply attributes treatment, pressure, reliability, and level of service, only treatment was significant, because previous studies from Buea (Meaney 2008) had suggested that pressure, water quality, and reliability were all attributes requiring urgent action. However, when evaluated for each gender group, pressure and reliability become significant. This suggests that for community water users as a whole, treatment is the only significant attribute. However, if community water were going to be designed differently for women than for men, then pressure and reliability could be tailored to their specific preferences.

Interestingly, whereas males tended to demonstrate strong preferences for the expected options, preferring treatment, higher pressure, and constant flow, women's choices were

more unexpected. While the preference for treatment was expected, females also slightly favoured low pressure and interrupted yet reliable flow. One wonders why, all other things being equal, when given the choice between low and high pressure, or between interrupted and constant flow, female community water users would tend to pick the option associated with a lower service level. Furthermore, the relative strength of females' preference for treatment is such that the implicit price for treatment improvements is nearly four times that of the next highest implicit price. In contrast, men's implicit price for treatment is only about two times that of the next highest implicit price. It would seem to underline the point, though, that for female community water users, improvements in pressure and reliability are not as important as improvements in treatment are.

This finding could be explained as follows. Given the important role of women in water management in Buea discussed in Section 4.1, one could assume that women in Buea know more about water than men and therefore can make more nuanced, informed decisions about water. This would seem to suggest that in answering the choice surveys, men answered stereotypically by preferring the higher service levels, whereas women made more nuanced choices, so their tradeoffs emphasised the realities of the situation. The realities of water collecting in the neighbourhood served by the GWM scheme, which women are more familiar with, are such that needs for access and convenience can be met by the several alternative sources in the neighbourhood such as stream, spring, and rainwater. Therefore, in the opinion of female community water users, if a proposed community water project were to add any value to water supply in the neighborhood, it

would be through the provision of treated water. Hence, women tend to strongly prefer treatment improvements as opposed to other service improvements in community water because in terms of access and convenience, their needs for untreated water can be met elsewhere.

Women also preferred the option of having scheduled intermittent flow for which it is known with certainty when it flows as opposed to having continuous flow. Similarly, this choice could have to do with the abundance of alternative sources of untreated water. A possible explanation is that women's choices were biased towards the more realistic and more immediately implementable scenario of scheduled, certain, intermittent flow. Any improvements towards continuous flow for the entire network would require a significant improvement in the engineering of the scheme, which would take more time and financial investments than is required by the scheduling scenario. The scheduling scenario could theoretically be implemented more immediately using the quantity of water that is currently available and with a smaller economic requirement, only requiring the additional manpower to make the system work. Women could be deriving utility from the fact that scheduled flow could be implemented sooner than continuous flow, thus providing them with the treated water option sooner rather than later. The fact that this water would be scheduled does not bother them because again, to satisfy the need for convenience they have access to alternative sources of untreated water, and the smaller volumes of treated water required for cooking and drinking can be obtained easily from a scheduled intermittent system.

It was found that women and men had different expectations of community-managed water. The conclusion that can be drawn from the findings in the previous paragraphs is that participation of both men and women in the planning and management of community-run water is important because cross-gender, inclusive discussions of water management can yield appropriate water solutions and help to meet users' expectations and hence improve their satisfaction.

4.6.2 Importance of treated water

However, the conclusions drawn above do not mean that the GWM scheme can go ahead and provide the community with safe, treated water that only flows once a month in a trickle. Fundamentally, all the choice sets were designed with the implicit assumption that in all the hypothetical situations, the community scheme is providing water. What the choice sets compared was users' relative valuation of improvements to individual attributes of a basic functioning scheme. That is to say, that users want a community water supply system that is functioning, supplying water, but that whether it is accessed via a private connection seconds away or a stand tap minutes or several hundreds of meters away is of very little importance. Furthermore, whether the water is flowing out slowly or bursting out of the tap, and whether users always have access to it or only at predetermined, regular times are also not so important. But if users were to design their scheme with one improved supply attribute in addition to a basic functioning scheme, it would be that the water is treated.

Based on their choices, community water users therefore seem to be acutely aware of the health hazards of drinking untreated water, and are placing a premium on having safe water. Urban community water users are more concerned with obtaining safe water from their community pipes rather than how easy it is to obtain. This fits in well with the context of the scheme—as was discussed in an earlier section, community water users have access to several alternative sources including a stream, spring, and rainwater. Thus, for the commodity of *untreated water*, they are relatively spoilt for choice, year-round. However, for the commodity of *treated water*, which is increasingly valuable as the health implications of untreated water are beginning to be understood, they have very few choices in their neighbourhood, so if they are going to use community water, it will have to provide significant added value, and supplying treated water does just that.

4.7 A role for PAR methodology in community water action in Buea

The methodology for this research was partly inspired by Participatory Action Research (PAR) methodology. First, as is typical of the community participation in PAR, the formulation of the research topic was strongly influenced by initial meetings and interviews with the management committee that highlighted the areas of most concern to the GWM scheme. This enabled the author to make his research more relevant to the context and to try to fulfill a real, self-felt need of the water supply scheme. Similar research projects should be carried out in the future with this participatory aspect in mind, as these types of applied research projects can be beneficial both to the researcher and the subjects in developing countries. PAR is also well suited to empowering the subjects to take ownership of their problems, shaping the research and then shaping the solutions.

One of the most valuable aspects of PAR methodology in this context was the direct dissemination of preliminary research findings to the stakeholders. After the main data collection and interviews had been completed, the author returned to the management committee of the GWM scheme and presented his initial findings to the chairperson. Based on the discussion that ensued, the chairperson decided to call a meeting of the water management committee and to invite residents from the community to attend. This simple sequence of events highlights the power of the PAR methodology in disseminating results, promoting action, and empowering participants. The subsequent water management committee meeting stimulated dialogue and discussion among community residents and the chairperson and mapped the first steps towards improvements for the future. It was decided, based on the discussions, to emphasise source protection and treatment of water, to pursue action to solicit contributions from the community for extension and improvement of the network, to research appropriate user fees based on the experiences of other functioning community water supply schemes in the region, and to write a letter appealing to the mayor to revamp the management committee (summary in Appendix I).

5. Conclusions: the consequences of urbanization on community-managed water supply and the way forward

5.1 Summary

The partnership between Helvetas Cameroon, the local community of the Great Soppo, Wokoko, Molyko community water supply (GWM) scheme, the local council, and local NGOs is fairly typical of community development projects. One of the roles that international development agencies such as Helvetas fulfill in such a partnership is that of the project consultant, using its decades of experience with community development projects in the country to set out best practices and lay the foundation for sustainability. However, a new context is rapidly emerging as many formerly rural and peri-urban areas are urbanizing. In this context, which needs to be recognized by the international community, community management structures are expected to function in urban settings and the traditional community management structures are in many ways directly at odds with the realities of urban areas. This thesis presented the findings from a case study and it would be useful to examine similar cases in other areas to determine if these results can be generalised to a wider context of small urban community management. The mechanisms through which participation breaks down in an urban setting may be particular to the context of Buea, which experienced fast population growth of "strangers" due to the creation of the university, and indeed participation may not necessarily be undermined in the same way in other community managed projects in urbanising regions, particularly those with more homogeneous populations, but it is safe to say that the challenges faced by urban community-managed water supply projects in developing countries are different to those faced by rural projects. The recommendations

from the GWM scheme's case are in accordance with some of the other research in this field. While the GWM scheme in Buea and the partnerships that led to its implementation has its particularities, there are lessons that can be generalised from this context. In particular, it highlighted the importance of a permanent presence from supporting agencies and NGOs, who would provide post construction technical support, and the presence of an entity in local councils or national institutions that would monitor participatory processes in order to ensure that the sustainability of these schemes is not undermined by the urban context.

5.2 Adapting the "hard" side: project planning and technical support

It was shown in the GWM scheme that the rapid population growth that is characteristic of an urbanising region undermined the original project plans, and contributed to the breakdown of the participatory model. First, community development projects, especially in the case of the GWM scheme being limited in the access to sustained external technical support, and having limited financial and managerial capacity, are not well-equipped to deal with the increased planning and management pressures brought about by urbanisation. This research and case study have shown that some modifications are needed in order to keep community-managed schemes relevant in the urban context; Kleemeier (2000), Whittington et al (2009) and Sun et al (2010) showed that forms of post-construction support and technical assistance are necessary for the sustainability of community schemes. Sun et al (2010) demonstrate that this could involve an institution resembling the independent Community Water and Sanitation Agency that successfully provides support to community water and sanitation committees (WATSANs) in Ghana.

NGO's should play a larger role in post-construction technical support and continue to work closely after implementation with the urban projects that they establish.

The various local NGO's that are involved in community water supply projects in the region are the legacy of valuable investments and contributions towards building local capacity made by international development agencies such as Helvetas Cameroon. For example, the NGO (Organisation for Rural Engineering and Environmental Development OREEDEV) that was responsible for the Great-Soppo Bonduma proposal that was described in Section 4.4.1 is made up of graduates from a technical school (SATA BTC in Kumba, Southwest Region) that was implemented by Helvetas Cameroon to build the capacity of local technicians and engineers to carry out local rural community development projects. However, the unfortunate finding of this research is that this technical capacity, while it may have been well suited to small rural development projects, is not yet adapted to the changing environment of community-managed development projects that are increasingly being implemented in urban settings.

The more complicated management decisions in urban settings require that management committees have access to more technical support and capacity throughout the life of the project that allows them to make more informed decisions when faced with urban planning challenges, and urban community-managed projects should be subject to more rigorous planning. For example, more sound population projections and assessment of source capacity are important inputs to the planning stage of urban community-managed

schemes, since these schemes are subject to more variable conditions than those experienced by rural schemes throughout their life.

5.3 Adapting the "soft" side: political and institutional support for participation

It was also shown how the particularities of the urban context contributed to the breakdown of the GWM scheme's participatory mechanisms. It was shown by Kleemeier (2000) that the standard participatory model is well suited to small rural schemes. However, this research and case study have shown that in the urban context, the standard participatory model needs more robust political and institutional support to ensure participation because of increased tribal diversity, reduced community mobilisation, reduced feedback from community pressures and community recognition, and increased logistical difficulties of participation. Management committees of urban community-managed water supply schemes (1) need to understand the importance of community participation for the success and sustainability of the scheme, and (2) they need to be given the political authority and independence to make changes in their structure and membership to account for demographic changes to the urban communities which they manage.

Furthermore, the main issue that was troubling the water management committee was the shortage of funds to carry out operation and maintenance on the scheme. It was found that many of the barriers to payment of user fees were related to lack of community involvement in the management committee and the associated lack of accountability of the management committee's operations and expenses. Additionally, this research

produced results that could help improve the design of community water user fees and service levels in Buea. Choice modelling revealed that access to safe water was the attribute of community water that users found most important to have. Community water in Buea should provide safe water, that does not necessarily flow continuously and that does not necessarily flow at high pressure. The research also suggests that there is a high willingness to pay for an appropriate system with these characteristics. Therefore, fulfilling users' expectations of community water and fostering a sense of ownership, involvement, and community participation suggests a promising way forward for the financial sustainability of the GWM scheme.

5.4 The future

Future work could apply a similar methodology to other urban community-managed projects in other parts of Africa and the developing world to analyse their sustainability challenges. To begin with, a similar analysis of neighbouring urban community-managed water projects in other parts of Buea may yield interesting comparisons of projects that are carried out under the same local governance and institutional arrangements. On a wider level, more assessments need to be carried out on the technical and operational challenges facing community-managed projects that have been implemented in urban regions of Africa—a notable example of which is the Community Water Supply and Sanitation Programme (CWSSP) in Dar Es Salaam, Tanzania—and in other parts of the world. Dar Es Salaam, where the institutional support for community management is relatively well-developed, could provide an interesting example of the effects of providing adequate support to community projects but may also highlight new areas of

support that could still be improved even where the institutional support and capacity is stronger.

The reality is that community-managed projects are usually implemented in developing areas where the small scope of the projects allow for quick solutions to urgent water supply problems, and can be implemented by NGO's and communities with limited capacity and resources. However, it would also be interesting to see what kind of challenges would be faced by similar small urban community-managed projects in developed countries. For example, in remote First Nations communities of Canada where community-style management of natural resources and especially water has been implemented, the stakes may be different owing to different cultural contexts, but perhaps the same fundamental challenges of ensuring adequate technical support would still be present. Lessons could be learned from community-management successes. However, the importance of this area of research for the developing world must be reiterated. As mentioned earlier, developing urban areas are today facing some of the highest population growth rates, and the concurrent growth in water services needed could be met effectively with well-implemented community management. Similar work should be done in other developing regions to assess the sustainability challenges of community-managed water supply in the urban context to try to establish an accessible body of knowledge on the subject and to build a consensus on the way forward for community management.

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Appendix I. Transcripts of Interviews

Transcript of the Interview with Mr. Becke-Smith, former mayor Buea Rural Council, current member of Great Soppo, Wokoko, Molyko Water Management Committee

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26 October 2010
15:00

Participants:
Mr. Becke-Smith (B)– member Great Soppo, Wokoko, Molyko Water Management Committee (SWMWMC)
Mr. Eko Peter Ekenya - technician, SWMWMC
Fidelis Folifac (F) – researcher
Zian Sally (Z) – researcher

Recorded on Nokia N81

F	… Chairperson of the Wokoko, Molyko, Great Soppo Water Scheme. We are having a conversation with him on the urban water supply
Z	In the beginning, what was the motivation behind setting up this scheme, was it because there was no water being provided by other servers?
B	I want to first welcome you to my home. I am known by Becke Smith Molwa, former mayor of the Buea Rural Council, who I served for 8 years. I took up position in 1987 and left in 1995, and I now continue to do other work serve the community. I'm sure my successors, had seen the need for water in these three villages, Great Soppo, Wokoko, Molyko villages and put up this project to supply this area with water because when SNEC put up their network, that area was farmland, there was no one living there, they were cultivating food, they did not think or preview that someday human beings would be living in that area so it was not included in the original network of SNEC. The contractor who was given the work was given specific instructions Six International) and he did just what was required. So the mayor during his term of office found need to at least find a source that he could tap water. I don't know precisely the year or the time. But I know that out of this good faith, the mayor put up the project, a three phase project. The first phase is what we are talking about now. Just the first phase. It was realized and we started working on it. Water was meant for 3 villages as I said earlier. But if you visit the network, you will notice that Great Soppo does not directly benefit because the catchment is in Great Soppo and because the other villages are supplied by gravity, the water cannot come up and be distributed to Great Soppo, so all of it goes down to Wokoko, Molyko. We have a T Junction somewhere down there, one goes to a certain quarter called Biyaka quarters, and that one continues right down to the university quarters intended for university dorms, students, and the like. The other phase goes through Wokoko and Wokoko…was uninhabited at the time the main water company was installing water. It was meant to go right down and serve the University of Buea. So the other phase of the comm. Water goes to Ndongo, Ndongo is a quarter in Wokoko, and in Ndongo the inhabitants and Cameroonians of good faith started building hostels, and two thirds of the hostels are

	accommodating university students. They are some of the inhabitants, so this community water is very very useful down there
Z	But the water is always flowing?
B	We have always tried to ensure that there is water in these pipes. But I will say that the demand is more than the supply now
Z	Even from your source here?
B	Yes, even from our source the demand is more than supply. But the irony is that if I take you to our supply tank, you will find water wasting and the men they want water? Because the distribution has not been improved. At the time they were projecting for this water supply, the community down there has more than doubled, because each year UB intake is 1000s and in five years, multiply that by 5000, it has increased by 25000 more than previewed population, yet this project has not been revamped. The pipes are still the same size, the catchment is the same, but demand is so much. The distribution means is our problem there. We don't have the means
Z	But people who are connected through individual connections?
B	The initial concept was only to supply public standpipes. But as time went on, there was a need to supply to hostels. Some hostels are upstairs, and you need a lot of pressure. Some of the people in community also saw the need for water in their homes. The past many years have suffered a lot of vandalism who break the pipes, do all sorts of things to the water, it is sometimes wasted in the bushes. We don't have the means to carry out security checks, but we have done our part, informed the police, but we have never heard that someone has been caught for vandalizing the pipes. So maintenance has been our greatest challenge.
Z	Are people making their own connections to the pipes, on their own terms? Do they consult with the committee
B	They do it, we have our own plumbers. But it is not possible to always check the pipe to control clandestine connections. We do it, and disconnect them. But our own duty is to ensure that there is water in the pipes every day.
Z	How? Monitoring?
B	Yes, we do that. We don't have budget, this is one of our problems. This is Buea Rural Council project, when they gave it to us, it was a challenge to see what we could do. We held meetings with beneficiaries, and came up with decisions which they do not honour. I tried my best with my executive and beneficiaries. We had an office [in Molyko] a meeting hall, one office, we employed a secretary, we sent out bills, like a company, collected money to pay workers, maintain line. At one point, consumers disappointed us. Not able to pay rent, pay secretary, unable to pay regularly, and pushed out of office, so now operate here in my house. Ledger here has a long list of consumers who are not willing to pay. That's our greatest problem. But we have tried as much as we can to ensure water in pipes
Z	When you say pay, what do you mean? Regular payment, or when there are problems

B	By decision, we decided regular monthly basis. We decided each consumer should pay x amount
F	What amount?
B	Public standpipes: 1500 F, reduced to 1000 F per house. Because those were the ones in majority. We didn't mind how many occupants in house, just one flat rate. University student hostel rate 5000 F. But there can be hundreds of students, and still pay flat rate. Some proprietors making business out of it, with submeters collecting money from the students for water, but still not paying the WMC the 5000 F due. Very "unpatriotic". We have tried to supply water every day to those pipes. There were 2 phases, we couldn't manage 2 phases anymore because of vandalism. The phase up to Biyuka's quarters was given up because of high rate of vandalism. We also moved from plastic to galvanized pipes because they are much stronger. Originally, we had galvanized pipes and moved to plastic. But Big trucks would crush our plastic pipes so we needed to replace them. Now we are managing one phase, which goes down to Ndongo, where there are more hostels. And trying also, because the need of people is very high, to supply them. The pipes have become too old, each time to maintain them, they have had to gum them, patch them, sometimes a little earth goes through. Even though the water is not treated, we don't have to touch the water so often. But because of the rate of destruction of pipes, we have to maintain them.
Z	Given all these challenges, do you see any way in which SNEC/CDE could come and collaborate? ON what terms could you collaborate, in which they could help you
B	Personally, we should not monopolize a utility which is life. Water is life, whoever supplies it, we want potable, treated water. Ours is not treated, theirs is. If they have the means and goodwill, then why not. Problem is unit cost not affordable, low class cannot afford. If there is a delay in the payment, not everyone gets a regular salary at end of month. A delay of 24h in payment attracts a penalty which is so high that people who do not get regular income do not want to deal with SNEC, so depend on community water. If I was asked the question, I would readily allow SNEC to supply potable treated water.
Z	Let's say I propose a hypothetical scenario. Presumably lower income people use less water, would it be feasible to use a differential rate
B	I think the water company can do it.
Z	But do you think there are any challenges to that?
B	I have not seen it anywhere, because let's take example of SONEL [electricity provider] whether you are poor/rich, they count your consumption and you pay what you use for. If they went down this classification, I'm sure everybody would be able to afford water. [Analogy of cars for different people]. If this classification could be done for water, utilities, it would be good. There is work to do in the community to sensitize people to run this project so it becomes a community project, their own. If they can own up to pay just 1000F each household and 5000F each hostel per month, they would be able to run these community water schemes. I know other towns which have succeeded, like Mutengene, Mbanso, etc. I'm sure that we can get more support from the council to sensitize the community to run these schemes. As soon as it goes to the corporation or company [becomes privatized], there is very little they can do to reduce or classify the rates of water.

Z	Why people so unwilling to pay?
B	Bad will. Because the water is there, it is free. Because it is Buea Rural Council water, it is free. We have told them that there is nothing free, because it has been harnessed. IF it was running like an ordinary stream, it could be free. But it has been harnessed to a catchment and pipes. With support from British taxpayers, Netherlands specialists, community also contributed with labour to set up the schemes.
F	I want to ask you specific questions to the project. How many households are connected to the project?
B	Attempted, with the ledger, to identify this. 2007: 151 people. 2008: less than 100. But all in all, if we make that census, it will be in the hundreds of people. At the time they were putting up the project, they were not as big. Now, far more than 500 down there at university. There are many hostels that use the community water….. They get connected with the WMC permission, with applications.
Z	But there is no way to control whether they pay or not?
B	We are trying, but that is the challenge. If they default, we disconnect them. But it is very risky, university students can rise up. They know the worker so well, one time, I received a phone call because they had taken him hostage. Give us water now or you don't go. They refused to send a delegate to talk to us, all of them wanted to talk to us [at once]. They finally sent a delegation. The hostel proprietors were not there. They are the ones who take money from them [the students] that's why it was difficult to manage that. If we had sufficient distribution means, we would be able to satisfy the needs.
F	I see the potential for self-financing of the system through the hostels. At that meeting at the chief's palace, I noticed that some key stakeholders were not present. Who are some of the key players to the system that need to be brought to the table to revamp this project?
B	The community of Wokoko, Molyko, Great Soppo, the university community or family, and the council. If they want to privatise the project, whoever will take this business will improve it and make money. It will be like a water company here. If SNEC takes the system, they will improve the system because the water is there all the time. ….The source is in Great Soppo… even though they are not benefiting or supplied. But the second phase, and the third maybe, if it was realized, would have been to pump water up to a tank in the highest points in Great Soppo (Baptist College) and distribute. Would not use SONEL, too expensive, but it was proposed to use solar energy, use booster pumps to a supply tank and distribute by gravity to anywhere. The centrifugal pumps at the supply points would always wear out always had to be replaced. It was gas powered, but people were unwilling to pay 200 F a month to keep the gas pump running, even though they were willing to pay 300 F per day on a beer. As mayor, we replaced them with electricity
F	….Who is responsible, who has the authority to invite stakeholders?
B	The mayor.
F	Why
B	Because Helvetas [Swiss development agency] set up the project, technical facility, and then handed over project

	to the council
F	Do you have suggestions on how sensitization towards payment for water could occur?
B	Carry out a campaign. There are some people who see the need, and pay voluntarily without force. IN order to keep their water flowing. Those who pay are the ones who cannot afford the two systems. Those who are rich enough, are connected to both SNEC and community. When both are flowing, they put off the SNEC and use community. We have cases of hostels who previously said no to community water have come back begging to be connected because SNEC bills are many times higher. These same proprietors tax students for water, make 99% profit on community water. The sensitization can be done by the Buea rural councils or by even us if we are given the means.
F	Let me be precise, what means would be needed?
B	We need financial means to travel, to carry out door to door advocacy in the communities. Call university dons, hostels, students, campaigning and sensitizing people….Or we can carry out quarter meetings, church meetings. For example, talk over the radio, newspapers, like the Cameroonian government was doing to inform people of vaccinations against a new virus.
F	If this sensitization picks up steam, do you think CDE SNEC will react badly, or run into some problems with them?
B	SNEC has a right to question us as far as water is concerned, they are the specialized company. But the question is, can they supply water to every Cameroonian? I think no. If no, so what should all the others do? I think it should be liberalized to some extent, the monopoly is what brings us with cost. If this [community] system advanced to provide treatment, it wouldn't be too expensive to maintain. We can introduce treatment station in community water. There are several community water committees in Buea. There is so much water but it is not exploited. The water corporation does not have the will to expand their network. They are not interested in exploiting the water in Buea. The accumulated water bills from standpipes in all local councils will never be paid because they are far above the budgets of the councils. If SNEC connected everyone to their network, they would be able to collect far more money, and capture the lost money from people using the free water from the standpipes indiscriminately without knowing the value of the water. In the morning, washing of one leg uses 2 L of water, because they don't understand the value, once they start to pay, they will feel the pinch. I have never been comfortable with SNEC because they are doing nothing to expand. For example, if they did something to take water to Ndongo, they would have so many customers. If they took over the community water, they would be able to supply all these people. …..
Z	Climate variability and impacts on community schemes
B	This is a worry we all live with. We live in a volcanic area. We've only experienced this once, that the water level has dropped so low. But this year, with the rains, we have a high level of water. But we cannot guarantee that it will be like this until December [heart of dry season]. We would like to discuss with the mayor how to distribute the surplus water that overflows—we need bigger pipes from the catchment to the supply tank and from the tank to the population. We need not only financial but also technical help. If we had the means, we

	would ration the water [maybe valves to control flow to different areas of network].

Transcript of the Interview with Mr. Becke-Smith, former mayor Buea Rural Council, current member of Great Soppo, Wokoko, Molyko Water Management Committee

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16 November 2010
16:00

Participants:
Mr. Becke-Smith (B)– member Great Soppo, Wokoko, Molyko Water Management Committee (SWMWMC)
Zian Sally (Z) – researcher

Recorded on Nokia N81

Z	Discussion with Mr. Becke Smith Molua, chairperson… You mentioned sensitization towards payment, but one thing that has come up in the interviews is the issue of accountability, to know what their money is being put towards.
B	People have the right to know. But when you invite people to a meeting they never come.
Z	Do you have a provision in your budget or something like that for maintenance?
B	Yes, have a maintenance fee, when you have a house like this, pay 2500 CFA per month so that you have access to our technicians. It is not even enough to pay meter rent if you're with SNEC. The highest we charge is 5000 CFA per month. It's not enough to even give workers a stipend to live on in a month.
Z	Some people are not seeing the fruits of their contributions. For example, they expect continuous supply, but they are not getting supply even if their houses are connected.
B	But that's nothing to do with the technicians, for instance December and January will be a difficult time for us. Sometimes for a whole week the water corporation (SNEC) does not supply water. On the other hand, we have some people who have never paid for 5 years, but they are having water. Our system is not sophisticated enough to control flow of water. WE are only using stopcocks. More than half the consumers don't pay the 5000. The accountability here is simple, because if we have to pay x amount of money and present our expenditure in a budget it will not even account really for the running of the system, because most of it is sacrifice. For instance if you place one plumber on min wage of 40000 CFA/month, he will never actually get paid that amount regularly. We don't have a budget.
Z	That's why people are reluctant to pay.
B	We used to have an office, and our rents stood at x amounts. Due to bad faith and because people would never pay us, we could never pay the rents, and the landlord pushed us out. No one has complained since, because anyway they don't pay. We send bills at the end of every month. To prepare bills and send them we need manpower. So now, I'm operating from this house. But if they wanted this, I am prepared to go to radio, help educate them, put our energy together, hold a meeting, but they never attend.

Z	How many people attend, is it the same people
B	Sometimes regular attendance from certain people. The people who attend are those who are connected. Hostel proprietors do not attend. Why don't they come? And even the 5000 francs is not paid regularly, I have a list of those who do not pay. They pay 5000 francs per month, and they have submeters. They are profiting. IF they gave use 5000 francs, we would be able to have people to permanently serve the system.
Z	What seems to have happened is that by connecting the hostels, this has contributed to other parts of the system being cut off from supply. That has contributed to this load on the system meaning that other parts of the system are not being supplied because water has been channelled. They are almost free riding, where they are
B	For instance, we concentrate especially on this side (south side) of the road, there's an area with a concentration of hostels, because it's the bush and there is space, and there is no SNEC network on this side. I have a personal feeling for theses students because they do not have access to other sources of water. On the other side, students live in hostels with SNEC water but they are complaining about the bills. But there are no two ways, you can either live in scarcity or live with more bills to pay. What we are saying is that we can dialogue, I am prepared to talk with them. My bias is with these students who are living in this area. I have seen the vice chancellor about it. The university should be involved, should help bring development to this area, they should help us improve this water system. It is for their dons who live in this part of the city and for their students. But the vice chancellor has never done anything. I have continuously increased the connection fee to the hostels in order to raise money.
Z	Who initially decided to connect the hostels?
B	It was the demand. The first priority was stand taps so that those who are old and sickly can obtain water from stand taps. There was consultation, even when deciding rates. But now no one is implementing. When people began to crowd the stand taps, the taps would break, and no one was there to contribute to repair them. The main consumers were the students, and they started drinking water from doubtful sources
Z	What efforts have been made to involve the local community in the management of water. Because presumably if they don't feel a sense of ownership they would not care as much.
B	I will talk with the mayor about this. I have told him to relieve me from this responsibility.
Z	People are willing to get involved.
B	I cannot involve them, because I was appointed by the council. I can only propose to the mayor that he should involve hotel proprietors, minicite proprietors in the management. There are members of the community, for instance I know one [..] in his term of office, they initiated this water. But before I took over the management of this water, there have been a lot of problems, like misgivings and all kinds of problems. They were going to go to court. The mayor was threatening to take the man to court because of mismanagement. There are people who are willing to come back, but I cannot involve them. It is the mayor who appointed this present committee. We can revamp it so that we have many more people, if that will be the reason for their contributing. We can account for money, have an office. You know, this thing has a political undertone. The mayor will not appoint people who will run his

	administration down. He may bring people there who will use their influence to do something else. With me there, he knows I will protect his interest. For example, someone will say I can offer 500 million and use this to win elections. It's complicated.
Z	Who is on management committee?
B	Management committee people, some are around this area, some are in Moliko, some are in Wokoko. They have developed cold feet over these years because they will need certain facilities that we don't have. They want allowance, but money is not there. I will propose to the mayor they should reconstitute that committee, appoint some other people who will be able to sacrifice.
Z	It is important to realize that there is a strong will from the users of the water to manage their water. They feel that it is important, and it is my understanding that it is important for them to feel this sense of ownership, responsibility, will start to have an interest in ensuring this scheme will function. Through that it will increase their willingness to pay, to contribute.
B	I understand this, and I am willing to recommend to the mayor this other step. We will recommend some people. I will make recommendations of people who can revamp committee and I will try that.
Z	Will you consult with community down there?
B	We have to consult in a meeting. I will invite all those people. I have a list of people who attended several meetings and they had cold feet. When we ask them to contribute money, they do not contribute. There are several hostel owners, with 50 students who do not contribute even the 10000 francs per month. The greatest problem we have is broken pipes, vandalism
Z	That is due to scarcity of water
B	People have to understand that it is nature, sometimes there is no water. IT is nature that the catchment is not as full as it needs to be. Sometimes it is because people vandalise pipes in the bush, and that causes a shortage of supply and pressure.
Z	I want to go back to question about initial connection of hostels. Was there any thought about whether catchment could supply this additional water.
B	We had a meeting, and saw that number of hostels THEN could be served with volume of water that we had. But today they have grown far beyond this. But we continued to connect them into their dwellings because they are in a position where they have no other place to get water.
Z	But at that stage did you weigh the pros and cons of having more standpipes vs individual connections?
B	Problem with more standpipes was one that we cannot control usage and payment. WE tried to give people responsibility to control the stand taps, but it was difficult. It is same situation as when the council cannot pay for public stand taps. The other problem is queues are very long, and wastage is very high too, with huge drums, inefficient use. I believe if people have public stand taps, there should be a performance contract, either with SNEC or community water, where one tap will be put at disposal of few people, responsible for maintenance of

	that tap, so that you know that tap is the responsibility of so and so, and he is one to contact.
Z	In fact I've heard this system has been used in Kumbo.
B	They have a feudal system of management in the North West, the feudal Fon has authority over his subject. We don't have this down in the South West. Here the taps are placed in quarters, we have quarter heads. But many things have gone wrong because the population has more than tripled so there is a lot of civil disobedience. These quarter heads don't have the same power as the Fons. So those kind of things don't work. But this is something that we should try again.
Z	It seems that these hostels have huge untapped potential. The students are coming from a background that they understand that they must pay for water. The barrier seems to be now between hostel residents and the management, because the residents don't have anything to do directly with the management, it's the landlords. Who has the power to get these landlords to attend?
B	Landlords are independent of themselves. They are stakeholders, they have invested their money, so they are the ones who deal with us.
B	More of the people who are not contributing are households, only 50% of hostels contribute. You cannot take them to court for nonpayment either because no performance contract. For example SNEC is able to disconnect you with nonpayment because they have the technical means. It was never conceived of in our system from the beginning.
Z	Would you say it's a functioning management committee?
B	Originally there were 12 people, secretary has been transferred, some people have died, but at the moment I seem to be the only one participating. I have three plumbers. It would be good to revamp he committee, involve some hostel proprietors, landlords. I am tired of doing it.
Z	For example, you approx 3.5 million francs for replacement of pipes. There are households willing to contribute 100000 francs each to raise 2 million francs for SNEC to extend pipes to neighbourhood.
B	Some hostel proprietor clandestinely connected his hostel to community line. We discovered through informants. We gave him a financial penalty for connecting without permission. He left us, went to SNEC. Less than 6 months later, he was back asking to be reconnected, because the bills are too high. Because compared to 5000 francs every month, for a two storey hostel, cannot compare to SNEC rates.
Z	You don't think that you can raise money from hostels? Isn't there a way to interact directly with students?
B	The money that is raised does not come here to committee. WE can only interact with hostel proprietors. There was rioting because of water problem in hostel in Ndongo, and they came here and said "Could you help us solve that problem". I said I don't think I want to, because among themselves, there is one caretaker, they collect money from students. Then he comes to WMC, and pays the 5000, the rest goes to landlord. And then when there is no water the next day, they are free to come ask me why no water, and we explain the problem, there is a broken pipe, or storage tank is being cleaned. There is a willingness of students to pay, and the other who doesn't think that, just 60000CFA per year, and many hostels don't pay. Now they misuse the money, and the students

	get angry because they are paying their money but not getting their money's worth because we are not getting the money. Like I said, if we can have 5 hostel proprietors involved, and a student representation, if that can help us generate enough administrative power, it would be in our interest.
B	There is no budgetary provision in the council for us.

Transcript of the meeting (group discussion) of the Water Management Committee and interested community members, Great Soppo, Wokoko, Molyko Water Management Committee

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30 November 2010

17:00

Participants:

Mr. Becke-Smith (B)– member Great Soppo, Wokoko, Molyko Water Management Committee (SWMWMC)

Mr. Eko Peter Ekenya - technician, SWMWMC

Community users/residents of Great Soppo Wokoko Molyko Water Supply Scheme

Fidelis Folifac (F) – researcher

Zian Sally (Z) – researcher

Mr. Kedia Bassibang (K) – moderator

Recorded on Nokia N81

[Some parts in Pidgin English]

B	…How they di see palaver for water, how dey see finances. Suggest something. Anybody get something to build small agenda. Researchers they don been take some sample feelings from the community and they come for tok me too, and they say how you fi think too, we go join, then after this meeting we go map the way forward. … We are building the agenda, which one is the first one.
	1. Water problems at the source—the catchment and the collection tank
	2. The management committee
	3. Demand and supply of water
	4. Finances
	5. General
	6. Solutions
B	We will start from the first one, Kedia, will you moderate.
	The first item is the problems at the water source.
	- No treatment, water is not safe - How can we treat, and protect catchment. - Best to confine the catchment, and treat the water. - When rain falls, the water comes out colored. Not well protected, rain erodes soil from neighboring plots and enters the supply. - The tank is full, flows very well, but water does not go out (distribution). Water comes down in small quantities, because the pipes are too small. - Need more standtaps—right now no means to carry water. Only 3 functioning.
	The management committee.
	- Who is on mgmt committee now? [Chairperson names members] council members, chiefs, Some people no longer in Buea, some people developed cold feet, no incentives. - What are the goals of the committee: restore order to the community scheme's management and further commitment to this social facility for the benefit for all. - Has this been fulfilled? How many times do they meet? It cannot be stated with exactitude. It is clear that the community has no idea of the proceedings of the meetings of the management committee, no idea of how often the committee meets, how effective the management is. When the meetings are called, management community members, chiefs, councilors, are supposed to attend. - Propose to write a letter to mayor appealing for revamp of mgmt committee.
	Demand and supply of water

	- People plenty pass water. - Problem of vandalism—mgmt committee has appealed to the police, the mayor, to no avail. Moved from galvanized pipes to plastic pipes, better for flow—but these are worse for security. Children vandalizing pipes. Some pipes burst from pressure, not properly buried, not properly joined. The ones in this project have been vandalized. Letters sent to mayor, appeal for security - Pipes are broken, water wasting. Several pipes are exposed. Big trucks run over the pipe, break them. - But people are vandalizing pipes because water is not flowing to other parts of the network. If water was flowing, people would not break pipes. - Community members would like to prioritize standtaps. It is impossible to control water separately. - This project was only meant for public standtaps. Meant for the underprivileged. - When pressure is not there, cannot supply water to all parts of the network. - One landlord has control over stopcock, sometimes diverts water to his place.
	Treatment of water - Perception by some people that water is still good quality, "our forefathers drank that water and lived longer than we did" - CAMWATER sent letter saying that community schemes should not be providing untreated water. - Should confine the source, not allow people to go nearby. - Mentioned that after rain, dirty runoff enters the water source, rainwater is coloured, due to rainwater from roofs of structures near catchment. - Water management committee has no power to enforce source protection. - Management committee was thinking of planting trees, but even that have no authority, because don't own the property.
	Suggestion from community member: The University of Buea is planning to run a water line through the neighborhood, one suggestion is that university provides a stand tap in the neighborhood. Especially since it is university's students who largely live in neighborhood. Mayor should talk with vice chancellor suggest providing water to neighborhood.
	Finances - Suggestion: make a census of the homes in neighborhood. After census, research other community schemes to understand their user fees, compare. - At the implementation: money came from foreign sources, Cam govt, and community contributions and labour. Rates were decided, and user fees were to be collected. But no-one paid. - Some contributions have already been provided by community, like from some hostel proprietors who are connected—this money will go towards the digging work that is currently being carried out to relay the pipe and increase the flow. - "People of goodwill, some university hostel proprietors are supporting the management committee with some funds."—Chairperson management committee - Write a letter to mayor appealing for changes. Get participation from community attending today as well as chairperson. Form a task force to lobby mayor, ask to appeal to vice chancellor of University. - Way forward: more communication, give people an opportunity to contribute. Community water should involve the community.
	[Light is failing and meeting is adjourned. Participants will meet again to draft a letter to the mayor to ask for revamp of the management committee and to appeal for support]

Appendix II. Sample Questionnaire and Choice Sets

TOWARDS ENSURING FINANCIAL SELF-SUFFICIENCY AND SUSTAINABILITY OF AN URBAN COMMUNITY DRINKING WATER SCHEME— CASE STUDY OF THE GREAT SOPPO, WOKOKO, MOLYKO SCHEME IN BUEA, SOUTHWEST REGION, CAMEROON—USER QUESTIONNAIRE

Date: Time:

1. Gender of respondent:
__Female __Male

2. What is your education level?
__<High School __High School __University

3. What is your household monthly income?
__<100000 CFA __100000-250000 CFA __>250000 CFA __No answer

4. How many people are there in your household?
__Respondent in Hostel __<3 __3-5 __>5

5. How do you access community water?
__House connection __Community standpipe

6. Why do you choose COMMUNITY water instead of CDE/SNEC water? Choose all that apply and rank where 1=most important.
__Cost __Distance __No CDE/SNEC water in my area __Reliability of flow __Quality of water
Other _____

7. Are you satisfied with the community water supply? How could management be improved?
_____
_____
_____

8. What are your expectations of community water? Have they been met? Explain why or why not and what would give you this sense
_____
_____
_____

WILLINGNESS TO PAY

9. Do you contribute financially, or otherwise, to the community water supply and how?
_____
_____

_____
_____

10. Has the community water management committee contacted you about paying for water?
__Yes __No

11. If you do not contribute to the community water supply, explain why?

_____
_____
_____
_____
_____

12. How much are you willing to pay for the community water supply services you currently receive? (Carry out bidding game starting from maximum(500 CFA/month, current payment level) in increments of 500 CFA)

_____

13. Choice Experiments. Administer choice cards and record preferences.

DEPENDENCE ON RAINWATER AND OTHER SOURCES

14. Do you harvest or collect RAINWATER when it rains? **15.** Size of storage:_____
__Always __Sometimes __Rarely __Never

16. Why do you collect RAINWATER? Choose all that apply
__Free __When CDE (SNEC) water is not flowing __When COMMUNITY water is not flowing

17. What do you use RAINWATER for? Choose all that apply and rank where 1=most important.
__Drinking __Cooking __Cleaning __Bathing Other:_____

18. Are there periods in the year when community water does not flow? Explain

_____
_____
_____

19. Do you use other sources of water besides community water and rainwater? Describe, what, when?

_____
_____
_____
_____

20. How do you cope with rainfall variability/unpredictability? How do periods of drought affect you?

_____

_____

_____

_____

Choice Sets

SURVEY 1

Choice Set 1

Attribute	**Alternative A**	**Alternative B**	**Alternative C**
Water Quality	Not Treated	Treated	I prefer my current status
Water Pressure	Low	High	
Reliability	Sometimes flows	Sometimes flows	
Access	Private connection	Standtap	
Price per household CFA/month	0	1000	
Which do you prefer?			

Choice Set 2

Attribute	**Alternative A**	**Alternative B**	**Alternative C**
Water Quality	Treated	Treated	I prefer my current status
Water Pressure	Low	Low	
Reliability	Always flows	Sometimes flows	
Access	Private connection	Private connection	
Price per household CFA/month	5000	1000	
Which do you prefer?			

Choice Set 3

Attribute	**Alternative A**	**Alternative B**	**Alternative C**
Water Quality	Treated	Not Treated	I prefer my current status
Water Pressure	Low	Low	
Reliability	Always flows	Always flows	
Access	Standtap	Private connection	
Price per household CFA/month	500	5000	
Which do you prefer?			

Choice Set 4

Attribute	**Alternative A**	**Alternative B**	**Alternative C**
Water Quality	Not Treated	Treated	I prefer my current status
Water Pressure	Low	High	
Reliability	Always flows	Sometimes flows	
Access	Standtap	Private connection	
Price per household CFA/month	0	500	

Which do you prefer?			

Choice Set 5

Attribute	**Alternative A**	**Alternative B**	**Alternative C**
Water Quality	Not Treated	Treated	I prefer my current status
Water Pressure	High	High	
Reliability	Always flows	Sometimes flows	
Access	Private connection	Private connection	
Price per household CFA/month	0	5000	
Which do you prefer?			

Choice Set 6

Attribute	**Alternative A**	**Alternative B**	**Alternative C**
Water Quality	Not Treated	Treated	I prefer my current status
Water Pressure	High	Low	
Reliability	Sometimes	Always	
Access	Standtap	Private connection	
Price per household CFA/month	0	500	
Which do you prefer?			

Choice Set 7

Attribute	**Alternative A**	**Alternative B**	**Alternative C**
Water Quality	Not Treated	Not Treated	I prefer my current status
Water Pressure	High	Low	
Reliability	Always flows	Always flows	
Access	Standtap	Standtap	
Price per household CFA/month	500	1000	
Which do you prefer?			

Choice Set 8

Attribute	**Alternative A**	**Alternative B**	**Alternative C**
Water Quality	Not Treated	Not Treated	I prefer my current status
Water Pressure	High	Low	
Reliability	Sometimes flows	Always flows	
Access	Standtap	Private connection	
Price per household CFA/month	500	1000	

Which do you prefer?			

SURVEY 2

Choice Set 9

Attribute	**Alternative A**	**Alternative B**	**Alternative C**
Water Quality	Treated	Treated	I prefer my current status
Water Pressure	High	High	
Reliability	Sometimes flows	Always flows	
Access	Standtap	Standtap	
Price per household CFA/month	0	5000	
Which do you prefer?			

Choice Set 10

Attribute	**Alternative A**	**Alternative B**	**Alternative C**
Water Quality	Not Treated	Not Treated	I prefer my current status
Water Pressure	High	High	
Reliability	Always flows	Sometimes flows	
Access	Standtap	Private connection	
Price per household CFA/month	1000	500	
Which do you prefer?			

Choice Set 11

Attribute	**Alternative A**	**Alternative B**	**Alternative C**
Water Quality	Treated	Not Treated	I prefer my current status
Water Pressure	High	High	
Reliability	Sometimes flows	Always flows	
Access	Private connection	Standtap	
Price per household CFA/month	5000	500	
Which do you prefer?			

Choice Set 12

Attribute	**Alternative A**	**Alternative B**	**Alternative C**
Water Quality	Treated	Not Treated	I prefer my current status
Water Pressure	Low	High	
Reliability	Sometimes flows	Sometimes flows	
Access	Private connection	Private connection	

Price per household CFA/month	5000	1000	
Which do you prefer?			

Choice Set 13

Attribute	**Alternative A**	**Alternative B**	**Alternative C**
Water Quality	Not Treated	Not Treated	I prefer my current status
Water Pressure	High	Low	
Reliability	Always flows	Always flows	
Access	Standtap	Standtap	
Price per household CFA/month	5000	500	
Which do you prefer?			

Choice Set 14

Attribute	**Alternative A**	**Alternative B**	**Alternative C**
Water Quality	Not Treated	Treated	I prefer my current status
Water Pressure	High	Low	
Reliability	Always flows	Sometimes flows	
Access	Private connection	Standtap	
Price per household CFA/month	500	0	
Which do you prefer?			

Choice Set 15

Attribute	**Alternative A**	**Alternative B**	**Alternative C**
Water Quality	Not Treated	Treated	I prefer my current status
Water Pressure	Low	High	
Reliability	Always flows	Always flows	
Access	Private connection	Standtap	
Price per household CFA/month	1000	5000	
Which do you prefer?			

Choice Set 16

Attribute	**Alternative A**	**Alternative B**	**Alternative C**
Water Quality	Treated	Not Treated	I prefer my current status
Water Pressure	High	High	
Reliability	Sometimes flows	Sometimes flows	
Access	Standtap	Standtap	

Price per household CFA/month	500	5000	
Which do you prefer?			

Appendix III. Questionnaire Open-Ended Questions Qualitative Data

Great Soppo, Wokoko, Molyko Community Water Supply Scheme Questionnaire Data

Qualitative Data Analysis

7. Are you satisfied with community water supply? How could mgmt be improved?

8. Do you feel a sense of ownership over community scheme? Explain why or why not and what would give you this sense.

9. Do you contribute financially, and how?

11. IF you do not contribute to community water, explain why?

18. Are there periods in the year when community water does not flow?

19. Do you use other sources besides community water and rainwater? What, when?

20. How do you cope with rainfall variability unpredictability? How do periods of drought affect your water?

Each response to questions are arranged under themes, and the number in parentheses after the statement is the count of how many times the statement was mentioned in all the responses.

Question	Themes
7.	HOW SATISFIED? IN OWN WORDS: Not at all satisfied (2). Not fully satisfied (2). Very Satisfied. WHY UNSATISFIED: Irregular flow (15). Poor water quality (2). No water. Low pressure (2). Insufficient number of taps (4). Mgmt committee collecting money but poor service (5). Government should support with funds. Ensure every hostel is supplied.
8.	WHY NO SENSE OF OWNERSHIP: We are not participating in management (10). Contribute but no improvements, water shortage (4). No contact with management committee (4). Taps have locks, certain persons have keys. Landlord connected, tenants pay landlord. EXPECTATIONS OF COMMUNITY WATER: Expectations are met (3).

	Want continuous flow (14). Regular flow (4). Low cost (3). Free water (2). Alternative provider to SNEC (5). Each person participates when work like maintenance is to be done (6). Water quality should be good, clean water (7). Contribute money (6). Treatment (4). Extended pipe borne network. Involve community in management committee (4).
9.	HOW DO YOU CONTRIBUTE: Contribute to our means (7). Contribute manually (4). When network needs to be repaired, mgmt committee comes or notice posted near tap (11). Pay regularly per year (5). Pay regularly per month (3). AMOUNT CONTRIBUTED: 15000 CFA/yr. 10000 CFA/yr. 5000 CFA/yr (2). 3000 CFA/yr. 2500 CFA/yr. 2000 CFA/yr. 3000 CFA/month. 1000-2000 CFA/month
11.	WHY DON'T CONTRIBUTE: Because we access water from public stand tap, it should be free (6). We already contributed manually (4). Landlord takes care of it (10). Would pay if had regular supply (4). Lack of accountability. Community water should be free (fine to pay SNEC for their water because they have technical knowledge for treatment) (2). WE have other options so don't pay. No one asks us. Should only pay for repairs.

18.	CHARACTERISTICS OF NO FLOW: Not regular, not predictable (all respondents demonstrated uncertainty using descriptions "sometimes," "not sure," "about," "random"). DURATION OF NO FLOW: 1 day without water. 2 days without water (6). 3-5 days without water (5). 1 week without water (5). 2 weeks without water (4). 1 month without water (4). 2 or more months without water (4). Insignificant, 5 hours in one month. WHEN DOES NO FLOW OCCUR: Throughout year. Weekends (2). Mornings (2). Around January, Feb-Mar, Nov-Dec (dry season) (15). June, July, August, rainy season when pipes get blocked with debris and plant growth (3). Maintenance (3). Mostly when students arrive, during school holidays no disturbances. Burst pipes, when people vandalise, taking water from broken pipes (7).
19.	ALTERNATIVE SOURCE: Use Ndongo stream when no community water (24). Use spring when no community water (15). Use Ndongo stream all the time because of long queues (2). SNEC water from other neighborhood/friends (4). Purchase water from vendors (4). SNEC tap in house. USES OF ALTERNATIVE SOURCES: All household uses, spring (8). All household uses, stream (5). Only for nonpotable uses, stream (11).
20.	EFFECT OF EXTREME RAINFALL EVENTS (DROUGHT OR HEAVY RAIN): When rain is heavy, water gets dirty, 1 hour after rain, water clean again (8). In rainy season, water clean. In dry season, water dirty (2). In dry season, water clean.

	Frequent rainfall washes roof. When rains, ease of burden of water shortage (4). When rain ceases quickly, shortage of water (7). No effect (8). COPING WITH INFREQUENT/UNPREDICTABLE RAINFALL: Depend on spring (3). Long daily trips to find water (9). Depend on taps that flow, in other parts of network (2). Depend on stream, stream always has enough water (7). Late to school, poor hygiene. Storing, Rationing (4).

Appendix IV. Household Questionnaire Responses

Key to variables:

Heading	**Information**
Sex	Gender (Male or Female)
Edu	What is your education level? (<High School, High School, University)
Income	What is your household monthly income? (<100000 CFA, 100000-250000 CFA, >250000 CFA, No answer)
Hostel	Is respondent in hostel? (Yes/No)
Nhhold	How many people in your household? (<3, 3-5, >5, some gave exact number)
Access	How do you access community water (House connection, community stand tap)
Whycomm	Why did you choose community water, first reason? (Cost, distance, No SNEC/CDE water in my area, Reliability, Quality of water, Landlord's choice)
Whycomm2	Why did you choose community water, second?
Whycomm3	Why did you choose community water, third?
Satisf	Are you satisfied with community water (Yes/No)
SensOwn	Do you feel a sense of ownership about community water? (Yes/No)
Doupay	Do you contribute financially to the community water scheme (Yes/No)
Contribute2Means4Maint	Dummy variable whether respondent pays for maintenance only when needed (Yes/No)
Howmuchupay	How much do you currently pay for community water (CFA/month)
ContMgmt	Has the community management committee contacted you about paying (Yes/No)
WTPCurrent	Think of the water you receive now. How much is the maximum you are willing to pay for it (CFA/month)
Rwater	Do you collect rainwater when it rains? (Always, Sometimes, Rarely, Never)
RwaterSize	Size of storage of rainwater (litres)
RwaterWhy	Why do you collect rainwater, first reason (Free, When community water doesn't flow)
RwaterWhy2	Why do you collect rainwater, second
RwaterUse1	What do you use rainwater for, first (Drinking, cooking, cleaning, bathing, other)
RwaterUse2	What do you use rainwater for, second
RwaterUse3	What do you use rainwater for, third
RwaterUse4	What do you use rainwater for, fourth

RwaterOtherResp	If other was chosen, what was the response
IrregularityFlow	Are there periods in the year when community water does not flow? (Yes/No)
OtherSourceUse	Do you use other sources of water besides community water and rainwater (Yes/No)

Tabulation of household questionnaire responses

	Date	Time	Sex	Edu	Income	Hostel	Nhhold	Access
1	2010-11-18	6:00 PM	Female	.	.	.	.	.
2	2010-11-18	6:00 PM	Female	High School	No answer	No	2	Community standtap
3	2010-11-18	5:00 PM	Female	<High School	No answer	No	6	Community standtap
4	.	5:15 PM	Female	University	No answer	Yes	1	House connection
5	.	6:00 PM	Female	University	No answer	No	7	Community standtap
6	.	5:00 PM	Female	University	<100000 CFA	No	2	Community standtap
7	2010-11-13	1:30 PM	Male	<High School	.	No	10	House connection
8	2010-11-12	.	Male	University	<100000 CFA	Yes	1	House connection
9	2010-11-12	4:45 PM	Male	University	<100000 CFA	Yes	1	House connection
10	2010-11-11	5:30 PM	Female	University	<100000 CFA	No	6	House connection
11	2010-11-10	5:45 PM	Female	University	<100000 CFA	Yes	3	House connection
12	2010-11-09	11:00 AM	Female	High School	100000-250000 CFA	No	<3	House connection
13	2010-11-08	5:00 PM	Male	University	100000-250000 CFA	No	<3	House connection
14	2010-11-08	5:00 PM	Female	High School	<100000 CFA	Yes	3-5	House connection
15	2010-11-08	5:00 PM	.	.	.	.	.	.
16	2010-11-13	.	Male	<High School	No answer	No	5	Community standtap
17	2010-11-13	11:00 AM	Male	University	<100000 CFA	No	3-5	Community standtap
18	2010-11-12	6:00 PM	Male	High School	100000-250000 CFA	No	12	Community standtap
19	2010-11-12	5:15 PM	Male	University	No answer	Yes	1	Community standtap
20	2010-11-10	6:00 PM	Female	University	<100000 CFA	Yes	1	Community standtap
21	2010-11-10	5:15 PM	Male	University	100000-250000 CFA	No	3-5	Community standtap
22	2010-11-08	6:00 PM	Female	University	100000-250000 CFA	Yes	1	Community standtap
23	2010-11-08	5:00 PM	Male	University	No answer	Yes	<3	.
24	2010-11-18	6:00 PM	Female	<High School	<100000 CFA	No	3	House connection
25	2010-11-18	6:00 PM	Male	University	<100000 CFA	No	4	House connection
26	.	5:30 PM	Female	University	>250000 CFA	No	8	House connection
27	.	.	Female	University	100000-250000 CFA	No	>5	House connection
28	.	.	Female	.	.	.	.	Community standtap
29	2010-11-13	.	Female	University	100000-250000 CFA	Yes	<3	House connection
30	2010-11-12	5:30 PM	Female	University	100000-250000 CFA	No	5	House connection
31	2010-11-11	6:00 PM	Male	University	<100000 CFA	Yes	<3	House connection
32	2010-11-11	5:00 PM	.	High School	No answer	Yes	<3	House connection
33	2010-11-10	4:30 PM	Female	High School	100000-250000 CFA	No	>5	House connection
34	2010-11-08	6:00 PM	Male	University	No answer	Yes	1	House connection
35	2010-11-13	.	Female	.	.	.	.	.
36	2010-11-13	.	Female	.	No answer	No	8	Community standtap
37	2010-11-13	.	.	<High School	No answer	No	7	Community standtap
38	2010-11-13	.	Female	University	No answer	No	2	Community standtap
39	2010-11-13	.	Female	<High School	No answer	.	.	Community standtap
40	2010-11-12	5:00 PM	Female	<High School	No answer	No	<3	Community standtap
41	2010-11-11	.	Male	High School	No answer	No	3-5	Community standtap
42	2010-11-11	.	Female	High School	No answer	No	3	Community standtap
43	2010-11-11	5:15 PM	Male	High School	No answer	No	3-5	Community standtap
44	2010-11-10	6:15 PM	Male	University	<100000 CFA	Yes	3	Community standtap
45	2010-11-10	5:30 PM	Male	High School	No answer	No	>5	Community standtap
46	2010-11-08	5:30 PM	Male	University	.	No	<3	Community standtap

	Whycomm	Whycomm2	Whycomm3	Satisf	SensOwn	Doupay
1	.	.	.			Yes
2	Distance	.	.	No	No	No
3	Quality of water	Cost	Distance	Yes	Yes	Yes
4	Landlord choice	.	.	Yes		Yes
5	.	.	.			
6	No CDE/SNEC water in my area	.	.	No	No	No
7	No CDE/SNEC water in my area	Cost	Reliability of flow	Yes	Yes	Yes
8	No CDE/SNEC water in my area	Landlord choice	.	No	No	Yes
9	Cost	Quality of water	Reliability of flow	Yes		No
10	No CDE/SNEC water in my area	Quality of water	.	Yes		Yes
11	Reliability of flow	Quality of water	Cost	Yes		No
12	No CDE/SNEC water in my area	Landlord choice	.	Yes	Yes	Yes
13	Reliability of flow	.	.	No	Yes	Yes
14	No CDE/SNEC water in my area	.	.	No		No
15	.	.	.			
16	Distance	.	.	Yes	Yes	Yes
17	Distance	.	.	No		Yes
18	No CDE/SNEC water in my area	.	.	No	Yes	No
19	No CDE/SNEC water in my area	Landlord choice	.	Yes		No
20	No CDE/SNEC water in my area	Landlord choice	.	No		No
21	Cost	Reliability of flow	.	Yes		No
22	No CDE/SNEC water in my area	Landlord choice	.	No	No	No
23	Reliability of flow	.	.	No		Yes
24	No CDE/SNEC water in my area	.	.	Yes		Yes
25	No CDE/SNEC water in my area	.	.	Yes	Yes	Yes
26	No CDE/SNEC water in my area	.	.	No	No	Yes
27	No CDE/SNEC water in my area	.	.		No	No
28	.	.	.			
29	Landlord choice	.	.	Yes	No	No
30	Reliability of flow	Cost	.	Yes	No	Yes
31	Reliability of flow	.	.	No		Yes
32	Cost	No CDE/SNEC water in my area	.	Yes		No
33	No CDE/SNEC water in my area	.	.	No		No
34	No CDE/SNEC water in my area	Landlord choice	.	Yes	No	Yes
35	.	.	.			
36	No CDE/SNEC water in my area	.	.	Yes	Yes	Yes
37	Cost	.	.	Yes	Yes	No
38	No CDE/SNEC water in my area	.	.	Yes	No	
39	No CDE/SNEC water in my area	Distance	Quality of water	Yes	Yes	No
40	Distance	No CDE/SNEC water in my area	Quality of water	Yes		Yes
41	Cost	Quality of water	Reliability of flow	Yes	Yes	Yes
42	No CDE/SNEC water in my area	.	.	Yes	No	No
43	No CDE/SNEC water in my area	Distance	.	Yes		No
44	No CDE/SNEC water in my area	.	.	No		No
45	No CDE/SNEC water in my area	.	.	No		No
46	Quality of water	.	.	No	No	No

	ContributeToMeans4Maint	Howmuchupay	ContMgmt	WTPcurrent	Rwater	RwaterSize	RwaterWhy
1	Yes	.	Yes	.	.	.	.
2	.	.	No	0	Never	.	.
3	Yes	.	Yes	500	Always	50	Free
4	.	1250	No	.	Rarely	15	When community water is not flowing
5	.	.	.	1000	Always	40	Free
6	.	.	No	300	Sometimes	15	When community water is not flowing
7	.	.	No	1000	Rarely	50	When community water is not flowing
8	.	.	No	500	Rarely	10	Free
9	.	1000	Yes	1000	Never	.	.
10	.	1500	Yes	1500	Never	.	.
11	No	.	No	500	Never	.	.
12	.	416.666667	No	416.666667	Sometimes	15	When community water is not flowing
13	Yes	.	No	1000	Sometimes	20	When community water is not flowing
14	.	.	Yes	500	Sometimes	20	When community water is not flowing
15	.	.	.	.	.	.	.
16	.	416.666667	Yes	1000	Sometimes	200	Free
17	Yes	.	No	500	Always	10	When community water is not flowing
18	Yes	.	Yes	0	Always	200	When community water is not flowing
19	.	.	No	500	Sometimes	24	Free
20	.	.	No	0	Rarely	15	When community water is not flowing
21	.	.	No	0	Rarely	50	Free
22	.	.	No	0	Sometimes	10	When community water is not flowing
23	Yes	.	No	200	Sometimes	200	When community water is not flowing
24	Yes	.	Yes	500	Sometimes	200	When community water is not flowing
25	Yes	833.333333	Yes	2000	Rarely	15	When community water is not flowing
26	Yes	3000	Yes	18000	Always	200	When community water is not flowing
27	No	.	Yes	0	Always	275	Free
28	.	.	.	.	Always	100	Free
29	No	.	No	500	Never	.	.
30	Yes	1500	Yes	1500	Sometimes	15	Free
31	.	.	No	500	Sometimes	15	When community water is not flowing
32	No	.	No	500	Sometimes	10	When community water is not flowing
33	No	.	No	0	Always	200	When community water is not flowing
34	No	250	No	250	Never	.	.
35	.	.	.	.	.	.	.
36	Yes	.	Yes	0	Never	.	.
37	.	.	Yes	200	Never	.	.
38	Yes	.	Yes	200	Rarely	25	When community water is not flowing
39	Yes	.	Yes	500	Sometimes	50	When community water is not flowing
40	.	208.333333	No	500	Sometimes	20	When community water is not flowing
41	.	2850	No	2000	Sometimes	50	Free
42	.	.	No	1000	Never	.	.
43	.	.	No	0	Sometimes	60	When community water is not flowing
44	.	.	No	0	Sometimes	15	When community water is not flowing
45	Yes	125	Yes	0	Always	200	When community water is not flowing
46	.	.	No	500	Always	.	When community water is not flowing

	RwaterWhy2	RwaterUse1	RwaterUse2	RwaterUse3	RwaterUse4	RwaterOtherResp	IrregularityFlow
1	.	.	.	.	.		Yes
2	.	.	.	.	.		Yes
3	When community water is not flowing	Cooking	Cleaning	.	.		Yes
4	.	Other	.	.	.	Flushing	Yes
5	When community water is not flowing	Other	Cleaning	.	.	Flushing	Yes
6	.	.	.	.	.		Yes
7	.	Other	Cleaning	.	.	Laundry	Yes
8	.	Cleaning	Other	.	.	Laundry	Yes
9	.	.	.	.	.		Yes
10	.	.	.	.	.		Yes
11	.	.	.	.	.		No
12	.	Other	.	.	.	Laundry	Yes
13	.	Cleaning	Bathing	.	.		Yes
14	.	Other	Cleaning	.	.	Laundry	Yes
15	.	.	.	.	.		.
16	.	Other	Cleaning	.	.	Laundry	Yes
17	Free	Cleaning	Other	.	.	Laundry	Yes
18	.	Other	Cooking	Drinking	.	Laundry	Yes
19	.	Other	Bathing	.	.	Laundry	Yes
20	.	Other	Cleaning	.	.	Flushing	Yes
21	.	Other	Cleaning	Cooking	Bathing	Laundry	Yes
22	.	Other	Cleaning	.	.	Laundry	Yes
23	.	Cleaning	.	.	.		Yes
24	.	Cleaning	Other	.	.	Laundry	Yes
25	.	Cleaning	.	.	.		Yes
26	.	Cleaning	Other	.	.	Flushing	Yes
27	When community water is not flowing	Cleaning	Other	.	.	Flushing	.
28	When community water is not flowing	Cleaning	Other	.	.	Flushing	Yes
29	.	.	.	.	.		Yes
30	.	Other	Cleaning	.	.	Laundry	Yes
31	.	Other	Cleaning	Cooking	.	Laundry	Yes
32	.	Bathing	Cleaning	Other	.	Laundry	Yes
33	.	Cooking	Cleaning	Bathing	.		Yes
34	.	.	.	.	.		Yes
35	.	.	.	.	.		.
36	.	.	.	.	.		Yes
37	.	.	.	.	.		Yes
38	.	Other	Cleaning	.	.	Laundry	Yes
39	.	Other	Cooking	Drinking	.	Laundry	Yes
40	.	Bathing	Other	.	.	Laundry	Yes
41	.	Cleaning	Cooking	.	.		Yes
42	.	.	.	.	.		Yes
43	.	Other	Bathing	Cleaning	.	Laundry	Yes
44	.	Bathing	Other	.	.	Laundry	Yes
45	.	Cleaning	Other	Bathing	.	Laundry	Yes
46	.	Cooking	Cleaning	Bathing	.		Yes

Appendix V. Choice model output

Main model output

Choice Model

Parameter Estimates

Term	Estimate	Std Error
Quality[Not Treated]	-1.07484262	0.2089555220
Pressure[Low]	-0.16311568	0.1689187761
Reliability[Always flows]	0.24331613	0.1632021237
Level of service[Private connection]	0.12277941	0.1582591439
Price per household per month CFA[0]	-0.24762820	0.3132346046
Price per household per month CFA[1000]	0.33254151	0.2155417375
Price per household per month CFA[500]	0.56413623	0.2208444498

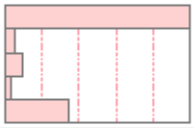
AICc	186.26562
-2*LogLikelihood	171.67923
-2*Firth LogLikelihood	146.35078

Converged in Gradient

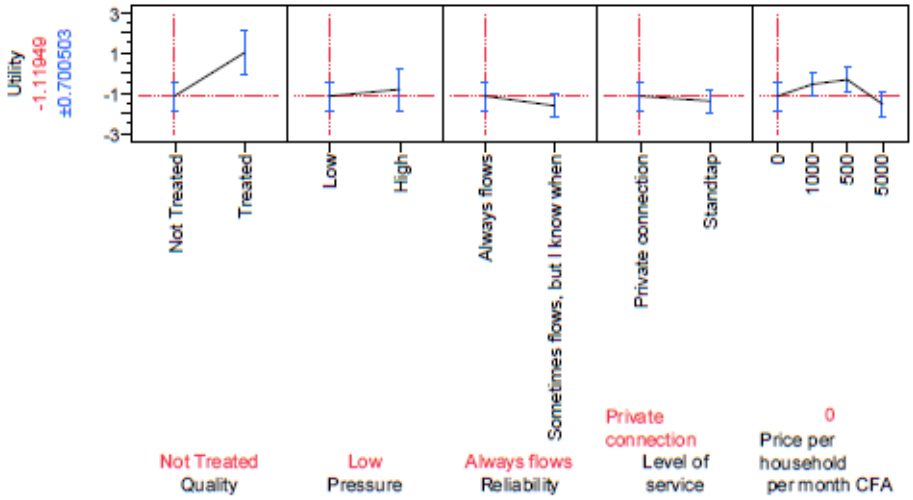
Firth Bias-adjusted Estimates

Effect Likelihood Ratio Tests

Source	L-R ChiSquare	DF	Prob>ChiSq
Quality	38.850	1	<.0001*
Pressure	0.949	1	0.3300
Reliability	2.281	1	0.1309
Level of service	0.628	1	0.4282
Price per household per month CFA	17.485	3	0.0006*

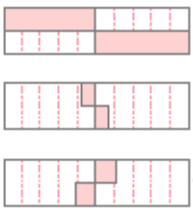


Prediction Profiler

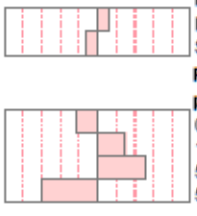


Marginals

Marginal		
-1.0748	Quality	Not Treated
1.0748		Treated
Marginal	**Pressure**	
-0.16312		Low
0.16312		High
Marginal	**Reliability**	
0.24332		Always flows
-0.24332		Sometimes flows, but I know when



Marginal		
0.12278	Level of service	Private connection
-0.12278		Standtap
Marginal	**Price per household per month CFA**	
-0.24763		0
0.33254		1000
0.56414		500
-0.64905		5000



Gender subject-effect interaction

Choice Model

Parameter Estimates

Term	Estimate	Std Error
Quality[Not Treated]	-1.30268940	0.2850836831
Pressure[Low]	-0.32212478	0.2028038625
Reliability[Always flows]	0.40686374	0.2091019450
Level of service[Private connection]	0.02518764	0.1817282794
Price per household per month CFA[0]	-0.06732765	0.3410171063
Price per household per month CFA[1000]	0.44339895	0.2621508272
Price per household per month CFA[500]	0.44255063	0.2496938447
Sex[Female]*Quality[Not Treated]	0.68695381	0.2850836831
Sex[Female]*Pressure[Low]	0.40840410	0.2028038625
Sex[Female]*Reliability[Always flows]	-0.58723427	0.2091019450
Sex[Female]*Level of service[Private connection]	-0.02284671	0.1817282794
Sex[Female]*Price per household per month CFA[0]	-0.80013073	0.3410171063
Sex[Female]*Price per household per month CFA[1000]	-0.22120893	0.2621508272
Sex[Female]*Price per household per month CFA[500]	0.48337679	0.2496938447

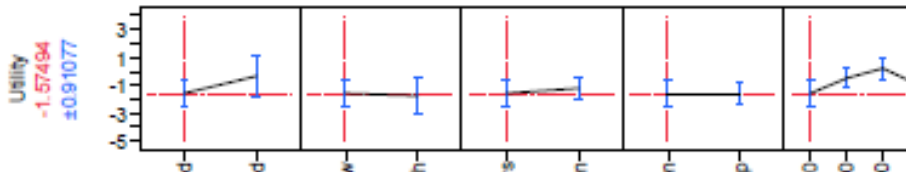
AICc	183.74156
-2*LogLikelihood	153.45895
-2*Firth LogLikelihood	105.44595

Converged In Gradient

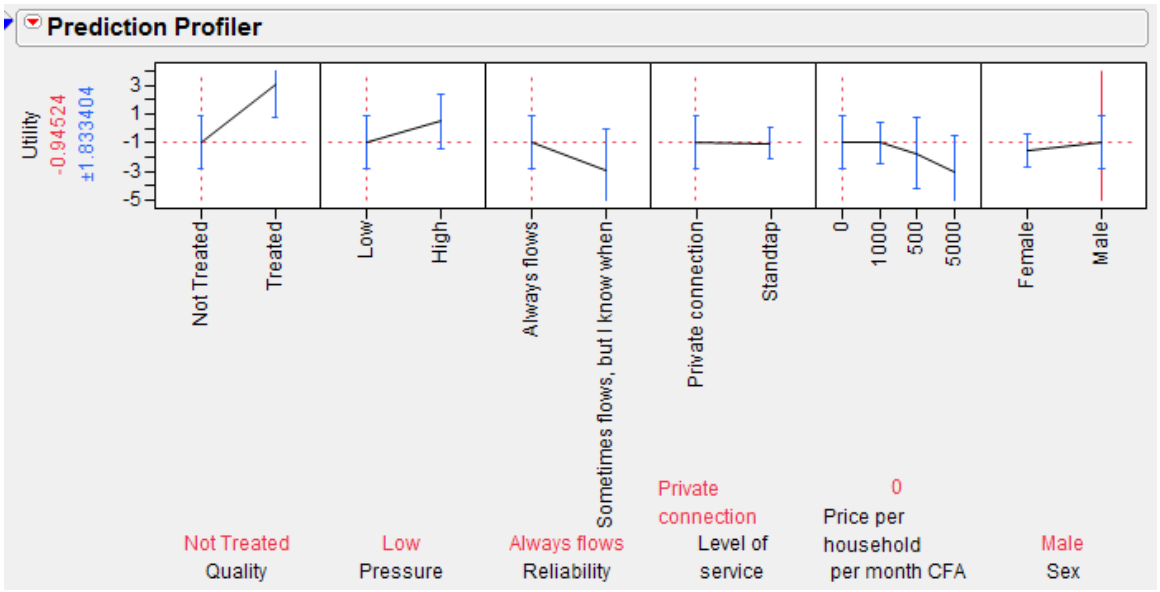
Firth Bias-adjusted Estimates

Effect Likelihood Ratio Tests

Source	L-R ChiSquare	DF	Prob>ChiSq
Quality	42.425	1	<.0001*
Pressure	2.755	1	0.0970
Reliability	4.252	1	0.0392*
Level of service	0.019	1	0.8899
Price per household per month CFA	14.918	3	0.0019*
Sex*Quality	7.755	1	0.0054*
Sex*Pressure	4.583	1	0.0323*
Sex*Reliability	10.019	1	0.0015*
Sex*Level of service	0.016	1	0.9001
Sex*Price per household per month CFA	9.752	3	0.0208*



Prediction Profiler


Prediction Profiler
Utility
-0.94524
±1.833404
3
1
-1
-3
-5
Not Treated
Treated
Low
High
Always flows
Sometimes flows, but I know when
Private connection
Standtap
0
1000
500
5000
Female
Male
Not Treated
Quality
Low
Pressure
Always flows
Reliability
Private connection
Level of service
0
Price per household per month CFA
Male
Sex

Income subject-effect interaction

Choice Model

Parameter Estimates

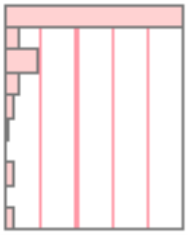
Term	Estimate	Std Error
Quality[Not Treated]	-1.4504513	0.429532
Pressure[Low]	-0.2760505	0.343599
Reliability[Always flows]	0.4293557	0.291744
Level of service[Private connection]	0.2310960	0.322568
Price per household per month CFA[0]	-0.1278274	0.606127
Price per household per month CFA[1000]	0.2649741	0.407073
Price per household per month CFA[500]	0.3346104	0.431449
Income[100000-250000 CFA-<100000 CFA]*Quality[Not Treated]	0.0230461	0.758405
Income[100000-250000 CFA-<100000 CFA]*Pressure[Low]	-0.1292018	0.514636
Income[100000-250000 CFA-<100000 CFA]*Reliability[Always flows]	0.0970759	0.495520
Income[100000-250000 CFA-<100000 CFA]*Level of service[Private connection]	-0.1820579	0.494047
Income[100000-250000 CFA-<100000 CFA]*Price per household per month CFA[0]	0.3055560	0.868001
Income[100000-250000 CFA-<100000 CFA]*Price per household per month CFA[1000]	-0.3606353	0.625170
Income[100000-250000 CFA-<100000 CFA]*Price per household per month CFA[500]	1.0817223	0.700339
Income[>250000 CFA-100000-250000 CFA]*Quality[Not Treated]	-4.5416879	7163.622911
Income[>250000 CFA-100000-250000 CFA]*Pressure[Low]	16.4464129	2355.384360
Income[>250000 CFA-100000-250000 CFA]*Reliability[Always flows]	2.2663453	6521.764979
Income[>250000 CFA-100000-250000 CFA]*Level of service[Private connection]	5.0672069	4510.218248
Income[>250000 CFA-100000-250000 CFA]*Price per household per month CFA[0]	-5.4428587	7571.502539
Income[>250000 CFA-100000-250000 CFA]*Price per household per month CFA[1000]	-6.7259584	0.620289
Income[>250000 CFA-100000-250000 CFA]*Price per household per month CFA[500]	4.3181061	0.661507
Income[No answer->250000 CFA]*Quality[Not Treated]	5.0081776	7163.622896
Income[No answer->250000 CFA]*Pressure[Low]	-16.1801571	2355.384330
Income[No answer->250000 CFA]*Reliability[Always flows]	-2.8011273	6521.764975
Income[No answer->250000 CFA]*Level of service[Private connection]	-5.1083670	4510.218244
Income[No answer->250000 CFA]*Price per household per month CFA[0]	4.6203909	7571.502521
Income[No answer->250000 CFA]*Price per household per month CFA[1000]	7.5257707	0.000000
Income[No answer->250000 CFA]*Price per household per month CFA[500]	-5.3665085	0.000000

AICc	218.61003
-2*LogLikelihood	153.05709

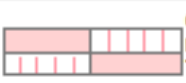
Converged In Gradient

Effect Likelihood Ratio Tests

Source	L-R ChiSquare	DF	Prob>ChiSq
Quality	18.862	1	<.0001*
Pressure	0.654	1	0.4188
Reliability	2.252	1	0.1334
Level of service	0.539	1	0.4629
Price per household per month CFA	1.895	3	0.5945
Income*Quality	1.017	3	0.7970
Income*Pressure	0.323	3	0.9557
Income*Reliability	1.533	3	0.6519
Income*Level of service	0.299	3	0.9602
Income*Price per household per month CFA	6.827	9	0.6552

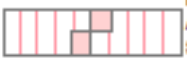


Marginals



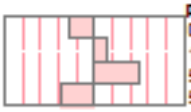
Marginal	Quality
-1.3526	Not Treated
1.3526	Treated

Marginal	Pressure
0.10702	Low
-0.10702	High



Marginal	Reliability
0.32845	Always flows
-0.32845	Sometimes flows, but I know when

Marginal	Level of service
0.21433	Private connection
-0.21433	Standtap



Marginal	Price per household per month CFA
-0.38200	0
0.21227	1000
0.67668	500
-0.50695	5000

Prediction Profiler

Education subject-effect interaction

Choice Model

Parameter Estimates

Term	Estimate	Std Error
Quality[Not Treated]	-0.606884445	0.375836360
Pressure[Low]	-0.093162694	0.355116363
Reliability[Always flows]	0.131275119	0.361186568
Level of service[Private connection]	0.303109571	0.324393729
Price per household per month CFA[0]	-0.707443903	0.684671159
Price per household per month CFA[1000]	0.230747461	0.458675962
Price per household per month CFA[500]	0.682343398	0.439806749
Edu[High School-<High School]*Quality[Not Treated]	-0.056907158	0.523591704
Edu[High School-<High School]*Pressure[Low]	-0.189860728	0.499074653
Edu[High School-<High School]*Reliability[Always flows]	-0.073574529	0.528526376
Edu[High School-<High School]*Level of service[Private connection]	-0.282147214	0.480820646
Edu[High School-<High School]*Price per household per month CFA[0]	0.575635169	1.010960468
Edu[High School-<High School]*Price per household per month CFA[1000]	0.436630607	0.675789178
Edu[High School-<High School]*Price per household per month CFA[500]	-0.295543015	0.652631784
Edu[University-High School]*Quality[Not Treated]	-0.704693580	0.482265421
Edu[University-High School]*Pressure[Low]	0.133320067	0.430087888
Edu[University-High School]*Reliability[Always flows]	0.316819584	0.444403361
Edu[University-High School]*Level of service[Private connection]	0.045586972	0.417990225
Edu[University-High School]*Price per household per month CFA[0]	0.084831996	0.856255531
Edu[University-High School]*Price per household per month CFA[1000]	-0.521212640	0.575426266
Edu[University-High School]*Price per household per month CFA[500]	0.135675711	0.580234259

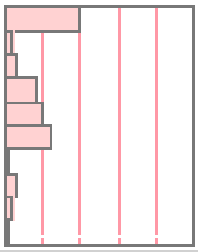
AICc	206.50373
-2*LogLikelihood	159.28339
-2*Firth LogLikelihood	168.39839

Converged in Gradient

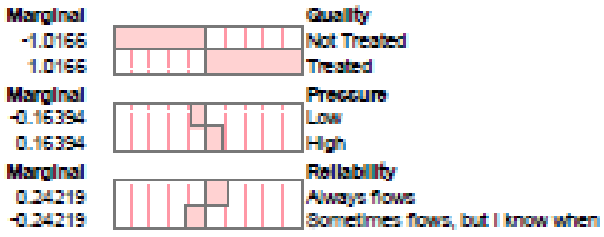
Firth Bias-adjusted Estimates

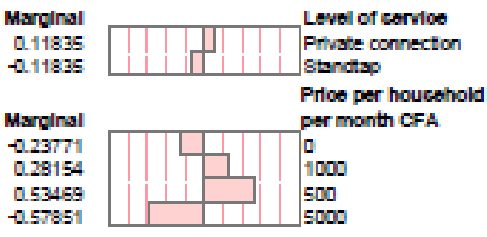
Effect Likelihood Ratio Tests

Source	L-R ChiSquare	DF	Prob>ChiSq
Quality	3.457	1	0.0630
Pressure	0.077	1	0.7811
Reliability	0.150	1	0.6984
Level of service	1.025	1	0.3113
Price per household per month CFA	4.021	3	0.2592
Edu*Quality	3.418	2	0.1810
Edu*Pressure	0.182	2	0.9131
Edu*Reliability	0.748	2	0.6880
Edu*Level of service	0.521	2	0.7709
Edu*Price per household per month CFA	2.243	6	0.8960



Marginals





Summary of choice modeling output:

*Water treatment and price are significant main effects

- Treatment is preferred to no treatment, and 500 CFA > 1,000 CFA > 0 CFA > 5,000 CFA
- Implicit prices: Treatment = 8,200 CFA/month/hhold, Constant flow = 1,900 CFA/month/hhold, High pressure = 1,200 CFA/month/hhold, Private connection = 940 CFA/month/hhold.

*Water treatment, reliability, pressure, and price are significant main effects when gender interaction is taken into account. This means that females and males have significant differences in utility and implicit prices with respect to water supply attributes water treatment, reliability, pressure.

- Females prefer 500 CFA to 1,000 CFA to 5,000 CFA to 0 CFA, prefer treatment to no treatment, prefer low pressure over high pressure, prefer interrupted flow with certainty to constant flow.
- Females implicit prices: Treatment = 4,400 CFA, Low Pressure = 610 CFA, Interrupted flow with certainty = 1,300 CFA.
- Males prefer 0 CFA to 1,000 CFA to 500 CFA to 5,000 CFA, prefer treatment to no treatment, prefer high pressure to low pressure, prefer constant flow to interrupted flow with certainty.
- Males implicit prices: Treatment = 8,700 CFA, High Pressure = 3,200 CFA, Constant flow = 4,300 CFA.

*Income and education interaction effects on water supply attributes are not significant.

Appendix VI. Datasheet about Great Soppo Wokoko Molyko Community Scheme

Data sources: Talk with Mr. Eko Peter Ekenya, technician, Great Soppo Wokoko Molyko Scheme; Field visit to the scheme.

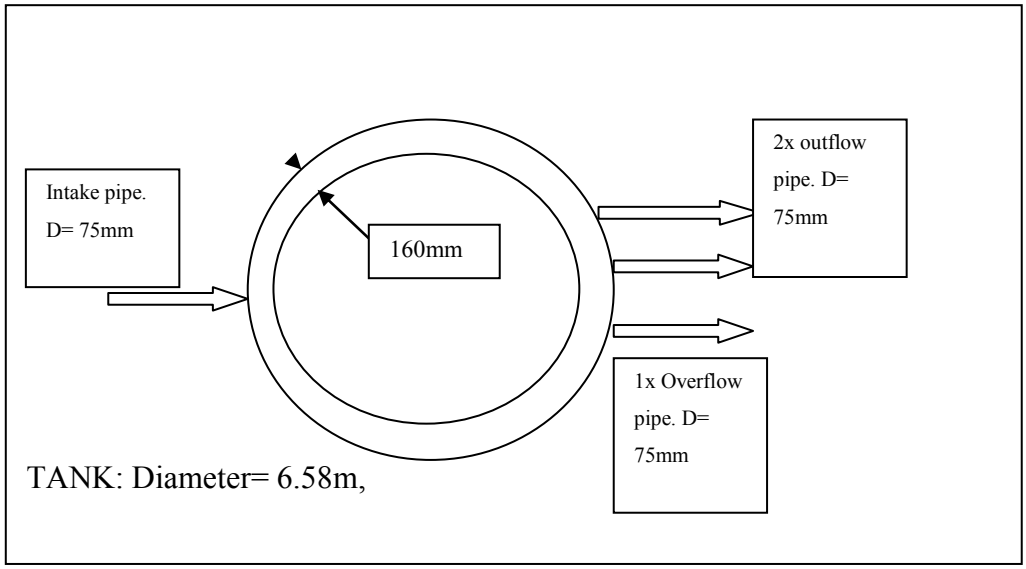


Figure A. Volume of the tank = 74 m3 = 74,000 litres

The supply tank's volume is 74 m3. There are three pipes flowing out of the supply tank, two identical pipes to the network, and one constantly flowing overflow pipe, which runs off into a stream.

Photo 1: There is a very large Mbuma tree (softwood) near the source, believed by the local community to be drawing up the water from the ground, contributing to raising the water table.

The catchment itself is a spring flowing out from the ground, the water is very cold, from a spring box built from stones and mortar, and the excess water that is not harnessed by the pipe to the tank, flows out as a stream.

Photo 2: Pipe above is used by residents around source to fill up buckets. Pipe from spring to the supply tank is underwater from right to left.

Photo 3: Spring emerges from the right side and there is a small dam and weir. The pipe to the supply tank harnesses water from that area. There is a lot of excess capacity that is not harnessed that flows out as a stream

Photo 4: The outflow from tank to the network (75mm pipe) and an overflow pipe. Excess capacity is evident.

If they had the means, the committee would plant more trees and vegetation, notably Indian Bamboo, in what they believe would be an attempt to raise the water table and increase the flow from the spring. Increased vegetation could increase infiltration which would raise the local water table. However, in reality, local vegetation would be unlikely to affect the local water table since the spring's water likely comes from a larger catchment.

Estimated flow in the GWM scheme network

Estimated flow in the GWM scheme network (current status)							
Location:		Tank	Junction 1	Stand Taps 1, 2	Stand Tap 3	Stand Tap 4	Total
Elevation	(m)	656	660	632	607	605	
Available Head	(m)		-4	24	49	51	
Pipe Length L	(m)	0	900	500	500	500	
Pipe Diameter d	(mm)		75	50	50	32	
Friction factor	f		0.025	0.024	0.024	0.022	
Discharge Q	(m^3/s)		0.00245	0.00245	0.001225	0.0006125	
Velocity V	(m/s)		0.555	1.248	0.624	0.762	
Reynolds number	Re		4.16×10^4	6.24×10^4	3.12×10^4	2.43×10^4	
Head loss h_f	(m)		4.707	19.064	4.766	10.172	
Total head loss h_{ftot}	(m)		4.707	23.772	28.538	38.710	
Total daily discharge	(m^3/day)			35.3	17.6	17.6	**70.6**
Population service potential	(50 litres/pers/day)			706 pers	353 pers	353 pers	**1411 pers**
	(20 litres/pers/day)			1764 pers	882 pers	882 pers	**3528 pers**

Head loss: $h_f = \frac{fLV^2}{d2g}$

F was calculated assuming smooth pipes, with a relative roughness of 0.001.

A single 75 mm pipe was assumed from the tank

Discharge is determined by modifying the discharge until the available head equals the total head loss, or until discharge equals the amount available from previous segments.

It was assumed that demand is uniform and uniformly distributed along the network from each of the stand taps and private connections. Hence, 50 % of the flow is extracted from Stand Taps 1 and 2, and 25 % each is extracted from Stand Tap 3 and Stand Tap 4.

The discharge noted in the table is that available at the start of each segment, before being subject to demand from the stand taps.

Between the tank and Stand Taps 1 and 2, flow is limited by the available head and pipe size. From Stand Taps 1 and 2 to Stand Tap 3, flow is limited by the amount of water available from the previous segments (i.e., 50 % of that available at Stand Taps 1,2).

Between Stand Tap 3 and Stand Tap 4, flow is again limited by the amount available from the previous segment (i.e., 25 % of that available at Stand Taps 1,2).

Therefore, supply is limited by the size of the pipe between Junction 1 and Stand Taps 1,2.

If the calculation is repeated, this time increasing the size of the pipe between Junction 1 and Stand Taps 1,2 from 50 mm to 75 mm, the results are as follows:

Estimated flow in the GWM scheme network (increased pipe size)							
Location:		Tank	Junction 1	Stand Taps 1, 2	Stand Tap 3	Stand Tap 4	Total
Elevation	(m)	656	660	632	607	605	
Available Head	(m)		-4	24	49	51	
Pipe Length L	(m)	0	900	500	500	500	
Pipe Diameter d	(mm)		75	75	50	32	
Friction factor	f		0.025	0.024	0.024	0.022	
Discharge Q	(m^3/s)		0.00446	0.00446	0.00223	0.0006467	
Velocity V	(m/s)		1.01	1.01	1.136	0.805	
Reynolds number	Re		7.57×10^4	7.57×10^4	5.68×10^4	2.57×10^4	
Head loss h_f	(m)		15.599	8.320	15.794	11.340	
Total head loss h_{ftot}	(m)		15.599	23.919	39.713	51.053	
Total daily discharge	(m^3/day)			41.1	27.1	18.6	**86.8**
Population service potential	(50 litres/pers/day)			822 pers	542 pers	372 pers	**1736 pers**
	(20 litres/pers/day)			2055 pers	1355 pers	931 pers	**4341 pers**

Now, capacity at 50 litres/person/day consumption has increased by 300 persons, and flow is now limited by the small head available in the last segment of the network.

Streamflow estimation

The scheme harnesses water from the Bulu spring source, but the entire spring is not harnessed. The excess flows as a stream through dense vegetation and bush towards Mile 16. An attempt was made to estimate the flow from this stream in order to obtain information about the excess capacity of the source. The methodology used, due to logistical constraints, was the floater method, using a partially submerged floater to estimate stream velocity, and using a measuring tape to measure channel cross-sectional area.

The measurements are instantaneous and represent a first estimate of the spring's flow in the tail end of the wet season. It is important to note that this year, rains have been prolonged into what is habitually the dry season from November to March. Unfortunately, there were many potential sources of error. Due to dense vegetation growth, much of the stream is hidden, passing through dense bush, or flowing underground or under vegetation growth. Hence, it was difficult to find a suitable site for velocity measurement. Furthermore, the nature of the streams is such that there is a main, narrow channel with fast flow and depth next to a shallower, slower, wider channel for which velocity measurement was infeasible due to rocks and debris and tortuosity of the water path. Hence, velocity measurements could only be made for the main channel, and as such sites were chosen where the main channel flow was maximized and the secondary channel was estimated. This results in very large estimated variance of flow. **The estimate below represents an estimation (± 50%) of the flow from the source.**

Two points were marked in the channel, at a distance of 5.4 m. The time (seconds) required for the floater (an orange) to traverse the reach between the two points was recorded.

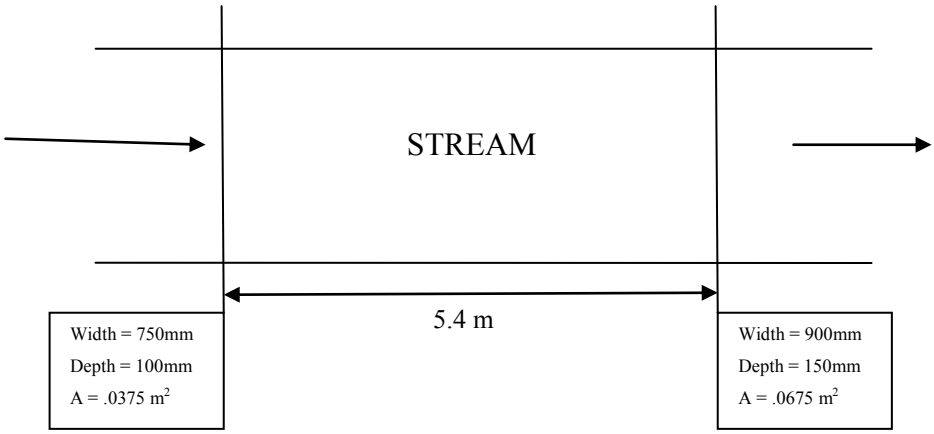


Figure B. Sketch of the stream reach

Table 1. Tabulation of time (s) taken for floater to traverse reach for velocity measurement	
Run	Time t (s)
1	7.4
2	9.1
3	8.4
4	7.5
5	8.1
6	9.2

Average t = 8.3 s.

Average A = .0525 m^2.

Surface V = 0.65 m/s.

Average V = 0.55 m/s

Therefore, Average Q = V/A = **0.058 m^3/s** (58 litres/s)

= **3.5 m^3/min**

= 210 m^3/hour = 5,000 m^3/day ± 2,500 m^3/day

(assuming a rectangular cross-section for the channel)