Escola Tècnica Superior d'Enginyers de Camins, Canals i Ports de Barcelona

UNIVERSITAT POLITÈCNICA DE CATALUNYA

KEY CHALLENGES IN THE GOVERNANCE OF RURAL WATER SUPPLY: LESSONS LEARNT FROM TANZANIA

Alejandro Jiménez Fernández de Palencia

Advisor: Dr. Agustí Pérez-Foguet

March 2010

Acknowledgments- Agradecimientos

En primer lugar, quisiera expresar mi más sincero agradecimiento para Agustí, por su lúcida orientación y su continuo apoyo durante estos años. Este proyecto de investigación no ha sido fácil, por heterodoxo en su ejecución y por su relativa lejanía de los temas más habituales de nuestro entorno; sin su ayuda no hubiera sido posible.

A Ingeniería Sin Fronteras-Asociación para el Desarrollo (ISF-ApD), a su Junta de Gobierno, equipo directivo, y a mis compañeros de trabajo, en especial a David Muñoz y Mª del Mar Rivero, por su tolerancia y su apoyo hacia mí durante estos años.

A la Universidad Politécnica de Catalunya, y en concreto al Centro de Cooperación al Desarrollo, al servicio de traducción y lenguas, y a la Escuela de Caminos. También quiero expresar mi reconocimiento a la Universidad Politécnica de Madrid, y al Colegio de Ingenieros de Caminos de Madrid.

A Emma, por su inigualable empatía y comprensión, y por hacer que todo a su lado resulte divertido y agradable. A mi familia y amigos, y en especial a mis padres, por su constante ánimo y apoyo.

A los que creyeron en mí, me ayudaron y animaron al principio: a Gonzalo Marín, a Jorge Molinero, Samuel Carpintero, y Carlos Mataix; y a los que me hicieron más fácil la travesía: a Ricard Giné y Jordi Pascual, que siempre estuvieron dispuestos a echarme una mano a distancia; a José Antonio Mancebo, por transmitirme siempre su encomiable entusiasmo; a Cristina Vela, por su apoyo en los momentos difíciles.

A todos los voluntarios que, de un modo u otro, formaron parte de este trabajo y a todo el personal expatriado de ISF-ApD en Tanzania durante estos años, en especial a Gema Mico, Cristina Mecerreyes y Celia Bedoya.

My sincere gratitude goes as well to all ISF staff in Tanzania, and especially ISF team in Same. Thanks to all of you for teaching me all I know about water in rural Tanzania.

I would also like to thank Same District Council, for their enthusiastic collaboration throughout this process, and especially to Mr, Iddi, District Executive Director, and Mr. Mtango, District Water Engineer.

And, of course, to the inhabitants of rural Tanzania, to whom this work is dedicated, Ninashukuru.

INDEX

"…Quién pudiera como tú
a la vez quieto y en marcha,
cantar siempre el mismo verso,
pero con distinta agua…"

Gerardo Diego, Romance del Duero, 1922.

"...if the misery of our poor be caused not
by the laws of nature, but by our
institutions, great is our sin".

Charles Darwin, The Voyage of the Beagle, 1909-1914.

INTRODUCTION

Even today, at least 880 million people lack access to safe water and almost 2,600 million do not have access to basic sanitation. Technical or physical problems are rarely the reason for this intolerable situation. To a large extent, it is a socially and politically induced challenge. The water crisis is increasingly about "water governance": the range of political, social, economic and administrative systems that are in place to develop and manage water resources, and the delivery of water services at different levels of society.[1]

This study addresses some of the key issues in the governance of rural water services in countries where there is a lack of access to water and high levels of poverty, especially sub-Saharan Africa. We focus on mechanisms that can improve efficiency, equity and sustainability at national government level, as governments are considered the key duty bearers in the provision of this basic social service and human right. To address the relevant aspects, Tanzania was taken as a case study, analyzed in depth, and compared with neighbouring countries. This research aims to contribute by addressing some of the challenges of improving water governance in the rural areas of these countries, and by discussing future issues.

The thesis proposal is organized in the following way. This chapter is divided into three sections. The first one describes the rationale for the selection of the research topic. The methodology is summarized in Section 2, and a brief summary of the research is given in Section 3.

The detailed research is presented in Chapters 1 to 7. Chapter one presents an analysis of the role of the different international actors in financing the water sector in developing countries. Chapters 2 to 5 deal with the analysis of the indicators that are available for international monitoring and propose and test new indicators based on the use of Geographical Information Systems (Water Point Mapping). Chapter 6 analyzes obstacles to the implementation of pro-poor policies from central government to village level. Chapter 7 presents an action research case study at local government level for the improvement of equity and sustainability in water services. Finally, Chapter 8 describes the overall conclusions of this work, and proposes some topics for future research.

[1] Rogers and Hall, 2003.

1. RATIONALE

1.1. The international context

The UN Water Conference held in Mar del Plata, Argentina, in 1977, proposed the period 1981-90 as the International Water Supply and Sanitation Decade, with the aim of delivering water-related services for 100% of the world's population. Even though targets were not achieved, water and sanitation appeared for the first time as a top priority in the development agenda. This main concern was taken up once more during the last decade. The Millennium Development Goals (MDG) include a specific target to cut in half, by 2015, the proportion of people that lack "sustainable access to safe drinking water". Later on, in 2002, this target was extended as well to basic sanitation (WSSD, 2002). Furthermore, the decade 2005-2015 was declared "International Decade for Action: Water for Life", but with very limited impact due to the lack of subsequent implementation plans. Along the same line, the year 2008 was declared the International Year of Sanitation, to stress the impact of poor sanitation and lack o hygiene on health, dignity and quality of life among millions of people.

Despite these political efforts, , data show that there has been only moderate progress to date , and huge inequalities appear when comparing access to water with access to sanitation, rural with urban areas, and trends within different regions (Table I.1).

Parameters	Water supply	Sanitation
World coverage	87%	62%
World rural coverage	78%	45%
World urban coverage	96%	79%
Estimated year for attainment of MDGs (world)	2016	2022
Estimated year for attainment of MDGs in Sub-Saharan Africa	2040	2076

Table I.1. Access to water and sanitation situation and progress towards MDGs (UNDP, 2006).

At the international level, monitoring of access to water and sanitation is being carried out by the WHO and UNICEF Joint Monitoring Programme for Water Supply and Sanitation (JMP), and this enables a rough idea on the number of people with access to improved facilities. Nevertheless, these data are not exhaustive and present significant limitations (Jiménez et al, 2009). The used indicators are far from representing the access to sustainable and safe drinking water, as is discussed hereinafter (Jiménez and Pérez-Foguet, 2008). In general, the paucity of consistent water-sector related data is another key constraint that is impeding effective progress (Biswas and Seetharam, 2008).

At the same time, donors are making an effort to improve aid effectiveness, as expressed in the Rome Declaration on Aid Harmonization in February 2003, and the Paris Declaration on Aid Effectiveness in March 2005. These concepts were included in the European Consensus on Development (EU, 2006). Aid effectiveness improvement is based on the following principles:

- Ownership: partner countries exercise effective leadership over their development policies and strategies, and coordinate development actions.
- Alignment: donors base their overall support on partner countries' national development strategies, institutions and procedures.
- Harmonisation: donors' actions will become more transparent and collectively effective.
- Managing for results: donors will have results-oriented frameworks.
- Mutual accountability: both donors and partners are accountable for results.

In practical terms, at least 85% of aid flows are reported in governments' budgets and use public financial management systems. Hence, most aid is channelled through sectoral or general budget support, and considerably increases ministries' budgets. In this context, we estimate that funds for the water sector that are channelled through national governments in aid recipient countries amount to around 70% of total financing, and around 20 billion dollars a year (Jiménez and Pérez-Foguet, 2009). Hence, the ability to track the performance of national governments remains crucial to the fight against water poverty and to increase access to services.

At aid recipient level, development policy has been influenced by two main factors: the Poverty Reduction Strategy Papers, which detail the specific poverty-related targets to be achieved in the period; and the decentralization of central government. The decentralization process has especially affected the water sector, since in most cases, responsibility for the demand and management of rural supplies has been shifted to communities, which should be now supported by different local government agencies (GoM, 1995; GoFDRE, 1999; GoU, 1999; GoT, 2002; GoG, 2008).

1.2. The specific conditions of the water sector

Water is an essential and non-substitutable good that has social, cultural and environmental roles (Savenije, 2002). It is indisputably the most politicized of public services. Developing countries have been greatly affected by the consequences of the ideological and political tendencies surrounding water. Although public service provision was predominant until the 1980s, this approach changed during the liberalization era, supported by the failure of the International Water and Sanitation Decade 1981–1990 (Carter et al., 1993). The Dublin Principles (Table I.2), which recognized water "as an economic good" (ICWE, 1992) were open to controversial interpretations. On the one hand, it gave support to the privatization of services (Lee and Floris, 2003). The Principles can be viewed as a means of making the right choices about the allocation and use of water resources on the basis of an integrated analysis of costs and benefits in a broad sense, aligned with the already existing concept of integrated water resources management (Savenije and Van Der Zaag, 2002). On the other hand a strong movement has defended the role of public institutions in the provision of basic social services (Hall and Lobina, 2004; Hukka and Katko, 2003), and the wider principle of considering water as a common good (Barlow, 2001, 2009; Bakker, 2007). However, the consideration of water as a human right contained in General Comment 15 of the Committee on Economic, Social and Cultural Rights of 2002 enforces clear obligations on governments to protect, respect, and fulfil this right (UN, 2002; Kiefer and Brölmann, 2005). This right has not been accepted by many countries, since they are unsure of the legal implications of it (Biswas, 2007), and its operational impact has to be further developed. Recently, an independent expert on human rights obligations related to access to safe drinking water and sanitation was designed by United Nations to shed light on the matter (HRC, 2008).

Although the international private sector has focused its attention over the past decade on the urban water supply subsector, the Dublin Principles have also reached rural areas. They were translated into what is known as the demand-response approach (DRA), which received considerable support during the 1990s (World Bank, 1997; World Bank, 1998). The underlying idea was that supply-led approaches were financially unsustainable and ultimately failed the poor. In focusing on water as an economic good and on the costs related to its supply, financial sustainability would result in improved services. Thus, users were brought into the process of selecting, implementing, and ultimately financing the long-term delivery of water services (ODI, 2003). The main aspects of the DRA are summarized in Table I.3. While this approach leads to greater participation of end users in the design and management of their services, it also means that they must assume the responsibilities and costs related to full operation and maintenance (O&M).

However, the sustainability of rural water supply programmes remains a challenge. Current estimations for Sub-Saharan Africa suggest that only two out of three water points (WPs) in the continent's rural areas are functional at any given time (RWSN, 2009), although there are no large data sets available to support this estimation. Other sources estimate the functionality of hand pumps at between 40% and 50% (Harvey and Reed, 2004), based on a wide range of studies in many countries. In Tanzania, 30% of systems have been estimated to be non-functional (GoT, 2002). Although this problem was identified long ago (Rao et al., 1987; Muyibi, 1992), the emphasis is frequently still on the fast development of new schemes, many of which stop working in a very short period of time.

Dublin Principles (ICWE, 1992)
Principle No. 1: Fresh water is a finite and vulnerable resource, essential to sustain life, development, and the environment.
Principle No. 2: Water development and management should be based on a participatory approach involving users, planners, and policy-makers at all levels.
Principle No. 3: Women play a central part in the provision, management, and safeguarding of water.
Principle No. 4: Water has an economic value in all its competing uses and should be recognized as an economic good.

Table I.2. Dublin principles

Main principles of the demand-response approach (DRA)
Communities must initiate the process of making the demand, normally with initial financial contribution.
Communities must contribute a certain percentage of capital costs towards their project (sometimes paid partially by in-kind labour) and 100% of O&M costs.
Communities must participate in all decision-making steps.
Communities own the system and are responsible for its management.

Table I.3. Main principles of the demand-response approach

1.3. Specific context of Tanzania

Tanzania is located in Sub-Saharan Africa. It borders Kenya and Uganda in the North, Rwanda, Burundi and the Democratic Republic of Congo in the West, Zambia, Malawi and Mozambique in the South, and the Indian Ocean in the East. It covers an area of 945,000 km^2 (Figure I.1). Tanzania's population of 41.3 million is made up of about 120 ethnic groups, comprising mainly Bantus. Tanzania is one of the poorest countries in the world with an annual per capita income estimated at $366 (UNSD, 2009). Its human development index is 0.530, and its position in human development rankings has risen from 164 to 151 in recent years (UNDP, 2009). The government of Tanzania is a union government that was formed in 1964 between two countries, Tanganyika and Zanzibar. The central government coordinates its activities in a decentralized manner that involves Regional Secretariats and local government authorities. Local authorities are made up of district councils for rural districts, as well as municipal and city/town councils for urban districts. From independence until the 1980s, Tanzania had a socialist system under J.K. Nyerere. Since 1992, it has had a multiparty democracy. CCM, the ruling party, has won all the elections (1995, 2000, 2005) until now. Tanzania is one of the most aid-dependent countries in the world, and is presently a "donor darling" in Sub-Saharan Africa. Official Development Assistance has been funding around 35 percent of government spending, and approximately 80 percent of the development budget (DPGT, 2009). It is also a country where both donors and government work progressively with General Budget Support (GBS) and donor coordination.

Figure I.1. Location and map of Tanzania

Tanzania has a long history of developing rural water supplies (table I.4) that began at the end of the 1940s, which was before independence. At that time, supplies were financed 75% by government funds and 25% by local authorities. The operation and maintenance costs were borne by local authorities from water rates and taxes. In 1965, shortly after independence, the government decided that rural water supplies would be 100% funded by the government and that water at public domestic points would be free. However, maintenance was still a local government responsibility. As local authorities were failing on their maintenance, in 1969 the government decided that it would assume this responsibility as well. Moreover, at the end of 1970, the party established an ambitious plan with the following aim: "by the end of 1990, people of rural Tanzania should have year round supplies of safe and wholesome water in sufficient quantities within a reasonable reach" (Tanzania Society, 1975).

Lack of sustainability was already significant during the mid-1970s, despite government promises. As early as 1981, Nyerere stated that users rather than the Government should be looking after the facilities (Nyerere, 1981). However, this did not become policy until much later. The promises of rapid coverage were also fostered by the International

Drinking Water Supply and Sanitation Decade (1981-1990). Donors, who provided 63% of funds for the country's rural water sector by 1980, widely supported this approach and switched from programme to project aid, which mainly involved detailed regional planning and support for further investment for implementation. In general terms, plans were not used and sustainability was very low (Therkildsen, 1988). The decade ended with 39% coverage in rural areas (JMP, 2009) and a new water policy was launched in 1991. It stated a new objective of providing clean and safe water to the population within 400 meters of their households by the year 2002. This target was not achieved either, since coverage stood at 50% in 2002. The main shortfall in the National Water Policy of 1991 was identified in the implementation strategies, which emphasised that the central government was the sole investor, implementer and manager of the projects in rural and urban areas (GoT, 2002), while part of the responsibility for O&M costs was shifted to the end users (Mathew, 2004).

In 2002, the target period ended and another water policy was launched, which is still valid today. According to this policy, central government plays the role of coordinator and facilitator in the water sector, while district level holds the main responsibility for implementation. A demand-response approach to service delivery is adopted, whereby communities should demand, own, and maintain their water services and participate in their design. All of the operation and maintenance costs are their responsibility, and they have to provide part of the capital costs through cash and kind. The main policy implementation instrument is the Water Sector Development Programme, whose rural component is the Rural Water Supply and Sanitation Programme (RWSSP). The RWSSP, which was officially launched in 2006, establishes targets for the percentage of the population in rural areas with sustainable and equitable access to safe water: 1) 65% by 2010 (goal set by the National Strategy for Growth and Reduction of Poverty, MKUKUTA), 2) at least 74% by mid-2015 (MDGs), and 3) 90% by 2025. If these targets are to be met, water supply coverage will have to be extended to an additional 33.8 million people during the period 2005-2025. Estimated costs for the rural component (excluding small towns) are 1,606 million US dollars (MUSD), with 1,465 MUSD for capital investment, 51 MUSD for management and operational support to districts and 17 MUSD for institutional strengthening and development (GoT, 2006).

Period and implementation arrangement	Target of coverage for rural areas	Roles and responsibilities	Coverage achieved in rural areas
1930-1970	No explicit target	▪ 75% financed by the central government and 25% by the LGA ▪ O&M paid by the LGA through taxes ▪ Passive role of the community	12% in 1971 (Tanzania Society, 1975)
1971-1990 Five-year development plans	100% coverage in 1990 (Nyerere, 1971)	▪ 100% financed by the central government ▪ O&M financed by the central government ▪ Community self-help initiatives for basic services	39% in 1990 (JMP, 2009)
1991-2001 Water policy 1991 (GoT, 1991)	100% coverage in 2002	▪ 100% financed by the central government ▪ O&M partially financed by end users (cost-sharing) ▪ Community only participates as regards O&M	44% in 2000 (JMP, 2009)
2002-2025 Water policy 2002 (GoT, 2002)	65% by 2010, 75% coverage by 2015, and more than 90% by 2025 (GoT, 2006)	▪ Approx. 90% financed by central government, 5% by LGA, and 5% by end users ▪ O&M by end users ▪ Community demands and fully participates in the design, implementation, and operation of services.	46% in 2006 (JMP, 2009)

Table I.4. Evolution of water provision roles in Tanzania

1.4. Topics addressed in the research

An analysis of the current context of water supply service delivery in Sub-Saharan Africa reveals some key issues related to governance:

- At international level, the MDGs have increased international attention to specific poverty-related targets. However, in the case of water, this has led to too much focus on infrastructure rather than on service. Too little attention is paid to the sustainability or quality of the service, which compromises the long-term effects on health and poverty.

- At national level, increased funds will be channelled from central ministries, according to the Paris Declaration. Hence, internal information systems and accountability procedures need to be in place to ensure effective resource allocation.
- At local government level, increasing responsibilities due to decentralization will lead to a greater influence on the promotion of equitable access to services and support for their sustainability.
- At community level, the entire responsibility for management of the services is endorsed; hence, more attention and support for organizational structures is needed.

This research addresses some of these aspects, and refers to the Tanzanian case study when relevant. It is focused on mechanisms that can improve efficiency, equity and sustainability at national government level, as governments are considered the key duty bearers in the provision of this basic social service and human right. We start by analyzing the international context. At this level, two aspects are addressed. First, in Chapter 1 we analyse the role played by the international actors in the financing of the water sector of developing countries, in the period 1995-2004 (Jiménez and Pérez-Foguet, 2009). The aim is to determine the impact of the actors on MDG fulfilment. Second, in Chapter 2 we study existing indicators for international monitoring (Jiménez et al, 2009). Some drawbacks are found the indicators' scope and methodology, which prevents them from being used as policy drivers at national level. As regards access to water, indicators associated with GIS-based Water Point Mapping (WPM) are proposed in Chapter 3 (Jiménez and Pérez-Foguet, 2008). The feasibility and relevance of adopting these indicators at national level was tested in two districts in Tanzania, as described in Chapter 4 (Jiménez and Pérez-Foguet, 2009b). A considerable difference was found between the current access figures and those calculated in a WPM campaign that included quality and seasonality measurements. Based on a WPM campaign covering almost 15% of the rural population in the country, conclusions about the sustainability of systems over time, and the relation between sustainability and technology are highlighted in Chapter 5 (Jiménez and Pérez-Foguet, 2009c). Chapter 6 analyses the aspects affecting resource allocation in Tanzania at all levels, from central government to village level. Policy incoherencies, technical weaknesses in implementation of the designed plans and political influences are highlighted as major

obstacles to the effective, equitable allocation of resources. Finally, more action research work was carried out at local government level. The improvement of equity and sustainability through local government were addressed for the case of Same District. The Water Department, supported by an international NGO, defined new equity-based priorities (using WPM as a tool) and institutional arrangements for the long-term support of community management, as described in Chapter 7 (Jiménez and Pérez-Foguet, 2010a). The overall conclusions and future research lines are presented in Chapter 8 (Jiménez and Pérez-Foguet, 2010b).
The methods used in the research are described in the following subsection. A brief description of each topic is given afterwards.

2. METHODS

2.1. Selection of the study country

It is believed that governance issues are influential at all decision-making levels, especially when the provision of a basic social service such as water is involved. Partial studies that only analyse one decision-making level can overlook key aspects at other levels in the chain. Hence, the methodology for this research is based on the selection of a country case study that can be analysed in depth and is representative of the challenges that we aim to describe. Tanzania was selected for the following reasons:

- Tanzania is a heavily indebted poor country (HIPC) with a low human development level that is involved in major international cooperation processes: it has Poverty Reduction Strategy Papers, and receives considerable aid through general and sectoral budget support mechanisms.
- Tanzania is undergoing a decentralization process that is fairly transparent considering the context, and has clear policies and documented programmes. The relatively calm political situation has enabled government functioning to be examined over a number of years.
- The Rural Water Supply and Sanitation Programme (RWSSP), which is funded by the World Bank and other international donors, is one of the biggest in Africa and aims to be a model for other countries.

- The availability of data from Water Point Mapping (WPM) campaigns provided valuable extensive input about the real conditions of water services in the rural areas, which was crucial to part of the research.
- The relationship with ISF, an international NGO that has operated in the country since 1998, gave us access to knowledge about the reality of the country and enabled us to carry out the action-oriented research.

2.2. Information sources and techniques

For the study of the international financing of the sector (Chapter 1), publicly available data sets from the Development Assistance Committee (DAC), the World Bank, and the Human Development Reports were collected and stored in a database. Official Development Assistance programmes were analysed individually to separate the water and sanitation subsectors. Disaggregated economic information from individual projects was used (11,743 pieces of data from the DAC and 306 from the World Bank database). The most relevant international indicators for water—the Joint Monitoring Programme indicators and the Water Poverty Index—were studied on the basis of the available references (Chapter 2).

We selected the Kigoma and Same Districts in Tanzania as pilot cases for the definition and testing of GIS-based indicators of water access (Chapters 3 and 4). The studies were carried out in 2006 and 2008 respectively, and covered 2,509 water points and around 840,000 people. The assessment of the sustainability of water points (Chapter 5) used information from three regions and 15 districts of central Tanzania, involving 5,921 water points and 4.25 million people (almost 15% of the country's total rural population). Surveys were undertaken between 2005 and 2006.

The information about Tanzania's rural water supply and sanitation programme at national level was obtained through interviews with Ministry of Water officials, along with an extensive review of unpublished and published documents from this Ministry and the Prime Ministers' Office. The analysis of the main decision makers at district level was based on field work conducted in four rural districts (Kigoma, Same, Iramba and Nzega) between July 2008 and August 2009. District councils were visited and interviews were held, particularly with district water engineers (DWEs) and district planning officers (DPLOs). For the purpose of understanding the drivers of resource allocation at lower levels of government (Chapter 6), four wards were selected in two districts (Same and Nzega). The aim was to include one ward with a historically low investment in water supply and one with a historically high investment in each of the districts. Interviews and group discussions were held with elected political representatives at ward, village and subvillage levels, as well as with government officers at village and ward levels. The village plans from the selected wards were examined and discussed with local government representatives and local political leaders.

Action research devoted to the improvement of the role of the LGA (Chapter 7) was carried out in Same District from 2006 to 2009, in the framework of an EU-funded programme. A joint working team was set up with members of the District Water Department and the NGO. Five people from the DWD, including the District Water Engineer (DWE), were involved at various steps of the process. We visited the country approximately twice a year between 2005 and 2009. The length of the stays ranged from a couple of weeks to four months. Additionally, the situation was contrasted with other countries, mainly to confirm the relevance of the processes under study. For this purpose, we visited Uganda (2005), Ghana (2007), Mozambique (2006, 2007 and 2008) and Ethiopia (2009).

Table I.5 describes the different types of study, scopes, and sources used in the research. Initial developments were presented at various conferences, including the 3rd Botín Foundation Water Workshop (Santander, Spain, June 2007), the International Water Resources Association's World Water Congress (Montpellier, France, September 2008), the IWA World Water Conference (Vienna, Austria, September 2008), the 33rd WEDC International Conference (Accra, Ghana, April 2008), the 34rd WEDC International Conference (Addis Ababa, Ethiopia, May 2009), the IWA 1st Development Conference (Ciudad de México, México, November 2009).

Improved versions of the research topics were submitted to relevant journals, and constitute the chapters of this Thesis, as detailed below.

Chapter	Type of study	Scope	Sources
Chapter 1	Desk study of financing of the water and sanitation sector	Public and private financing from DAC to OCDE aid receiving countries.	DAC, UNDP and World Bank databases
Chapter 2	Desk study of available indicators for monitoring the rural W&S sector	Water Poverty Index (WPI) and MDGs indicators from the Joint Monitoring Programme (JMP)	JMP and WPI data by country.
Chapter 3&4	Enhanced Water Point Mapping study	Same & Kigoma Districts (Tanzania), involving 2509 water points (WP) and aprox 840000 people.	Own data collected
Chapter 5	Analysis of sustainability of water services based on WPM data	Tabora, Dodoma, and Singida regions (Tanzania), involving 6,814 WPs in 15 districts, and a rural population of aprox 3.95 million people.	Wateraid water point mapping data
Chapter 6	Research about the allocation of resources in the national W&S programme	Allocation of resources from national level to districts (whole country). Survey in 4 districts (Same, Kigoma Rural, Nzega, Iramba) for Local government level.	Own information collected from Ministry officials, district councils, and village authorities.
Chapter 7	Action research for improving resource allocation mechanisms at District level	Same District	Activities developed between 2006 and 2009

Table I.5. Summary of type and scope of studies included in the Thesis.

3. TOPICS

3.1. International investment in the sector: evolution in the decade 1995-2004 and perspectives

Chapter 1 presents the main results of a detailed study of Official Development Assistance (ODA) and international private investment in the water sector from 1995 to 2004. The main goal of the chapter is to assess the international contribution to the Water and Sanitation sector in developing countries. We have created a database containing publicly available data sets from the Development Assistance Committee (DAC) the World Bank and Human Development Reports (population and water and sanitation access figures). The chapter includes a comparative analysis of public and private international investment. It assesses the geographical and sectoral coherence of aid allocation, as well as the terms and conditions of the ODA delivered. Finally, it assesses private participation success in the sector and evaluates cross-cutting issues in ODA water programmes. This work was published in the International Journal of Water Resources Development (Jiménez and Pérez Foguet, 2009).

Our analysis of ODA demonstrates how far donors lag behind their own commitments both in terms of the quantity and quality of aid delivered to the sector. Large geographical inequalities are revealed when the share of aid received by regions is compared with the number of people without access who live there. The data also demonstrate a lack of coordination among donors to set priorities. With regard to the allocation of funds in subsectors, most of the funds provided by multilateral and bilateral donors were dedicated to large systems. This is particularly unsettling when we consider rural populations' lack of access to water and the supposed poverty-orientated tendency of ODA. The average investment from bilateral donors was 2.41 times more in water projects than in sanitation projects. International private participation in water and sanitation projects shows little contribution to the achievement of the MDGs: 98% of investment was dedicated either to medium-income or high-income countries and mostly allocated to mixed projects that cost over 100 million dollars each. Meanwhile, Africa benefited from only 0.95% of the investment during the study period. Simultaneously, private participation was rather conflictive, with 28% of the investment allocated during the study period being cancelled or experiencing problems. Few complementarities were found between international public and private investment from the perspective of people without access, since the biggest aggregated investment per capita was for the continents with the lowest number of people without access to water and sanitation.

3.2. Study of available water sector indicators: the need to define EASSY indicators

This chapter tackles the challenge of analyzing the current status of monitoring water poverty in developing countries. This work was prepared for the 3rd Marcelino Botin Water Forum and published as a chapter of a book (Jiménez et al, 2009). It demonstrates the need for proper monitoring of water sector performance at national level. Traditional indicators of water supply access (WHO/UNICEF 2000, 2005) and other more comprehensive indicators (Sullivan, 2002; Chaves and Alipaz, 2007) do not provide a sound methodology for water sector monitoring on a yearly basis. We analyse the characteristics of the Water Poverty Index (WPI) for tracking the water and sanitation sector in developing countries. The relationship between water poverty, human development and human poverty is analysed and it is seen that, even though WPI is the best tool that is currently available for measuring water poverty, it is still not appropriate for tracking the water sector at national level. The appendixes contain the detailed statistical analyses on which the conclusions are based.

As a result of this situation, new tools and indicators are required for monitoring the water and sanitation sector. The importance of tracking the water sector's performance on a yearly basis makes it essential to include sector-specific routine data collection that can give yearly outputs, as implemented in other basic social sectors such as health. Hence, in the short term, information has to be readily available at local level at a reasonable cost, even if some aspects are oversimplified. Simultaneously, the inclusion of routine data collection at the lowest appropriate level would enable better tracking of transparency and accountability at all levels, and would increase national awareness of the importance of systematic data collection. It is concluded that there is an urgent need to define EASSY (**E**asy to get at local level, **A**ccurately defined, **S**tandard and internationally applicable, **S**calable at all administrative levels, **Y**early updatable) variables for monitoring the water sector's performance. Chapters 3 and 4 describe some initiatives involving the use of WPM to construct EASSY access indicators.

3.3. *Enhanced Water Point Mapping to define EASSY water access indicators: evidence from Tanzania*

This chapter examines the definition of EASSY water access indicators in more depth. This work was published in Water Science and Technology: Water Supply (Jiménez and Pérez-Foguet, 2008). As water service is provided by water points that are distributed across the territory and by many different actors, indicators must be integrative from the lowest level, to include all the actions performed in a certain area and to allow for local and regional trends. Some projects involving water issues and Geographical Information Systems (GIS) have been undertaken in different countries in recent years. These have been related to rural water supply (Van Wonderen and Ravenscroft, 2000), risk mapping (Godfrey et al, 2003) or groundwater mapping (Tindimugaya, 2004). Geographical information systems have a major potential to further involve end users and to improve participation, and are already being applied in the water sector (Jankowski, 2009; Ramsey, 2009). Water Point Mapping linked to GIS is proposed as an alternative to establish EASSY water access indicators. Standard Water Point Mapping, as initially developed by WaterAid (WaterAid and ODI, 2005), overlooks vital aspects of water supply, such as the quality and physical vulnerability of the service. Water quality has frequently been absent from debates, despite its importance (Biswas, 2005). Nevertheless, some recent works have brought attention to the issue, through the evaluation of specific projects (Hoko, 2005; Hoko & Hertle, 2006; Bordalo & Savva-Bordalo, 2007) or parameters, when such a risk is known to exist in a certain area (Rieman et al., 2003; Cortes-Maramba et al, 2006; Tekle-Haimanot et al., 2006; Mora et al, 2009). However, there are few examples of regular monitoring of the quality of rural water supplies. The chapter proposes Enhanced Water Point Mapping (EWPM) as a basic method that includes quality testing and seasonality. In this method, basic water quality tests are undertaken and the resource's seasonality issues are processed. We also discuss the feasibility of the indicator, in relation to the pilot experiences. The new definitions of the proposed indicators are presented in Table I.6.

Indicator	Calculation
Improved Community Water Point Density (ICWPD)	Number of improved community water points (ICWP) per 1000 inhabitants.
Functional Community Water Point Density (FCWPD)	Number of functional ICWP per 1000 inhabitants.
Year Round Functional Community Water Point Density (YRFWD)	Number of ICWP working at least 11 months per year per 1000 inhabitants.
Bacteriological Acceptable Water Point Density (BAWD)	Number of functional ICWP with an acceptable number of coliforms at the time of the test per 1000 inhabitants.
Bacteriological Acceptable and Year Round Functional Water Point Density (BA&YR-WD)	Number of ICWP working at least 11 months per year with an acceptable number of coliforms at the time of the test per 1000 inhabitants.

Table I.6. Indicators used by water point mapping

3.4. Quality and seasonality of water delivered by improved water points

This chapter reports the findings of the two water point mapping studies carried out in the Same and Kigoma Districts of Tanzania that covered 2,509 water points and 838,594 people. The studies added basic quality parameters and characterization of the seasonality of services to the data collected in standard water point mapping campaigns. The study, in an earlier version, was presented in an international conference (Jiménez and Pérez-Foguet, 2009b). Both quality and seasonality results were analyzed and disaggregated by water point technology.

Results show that the presence of coliforms is the main water quality problem. When the information was disaggregated by category, about 40% of ground water points were found to be polluted, together with 30% of gravity-fed systems. Seasonality also affected services in up to 30% of cases, depending on the category and geographical location of the water point. In an analysis of the results by the networks that they belong to, coverage was reduced by one quarter when the presence of coliforms was considered, and by between 20% and 33% with seasonality. When quality and seasonality were combined, the coverage figures were a factor of 0.57 and 0.55 lower for the districts than when functionality was considered alone.

The results were extrapolated to three regions of central Tanzania, involving 5,921 water points and 4.25 million people (almost 15% of the country's total rural population), to highlight the influence that a consideration of these factors would have on national coverage figures. The study shows that more than 50% of functional improved water points can be expected to have either quality or seasonality problems, which is in agreement with similar studies in the literature. Thus, ‘access to sustainable and safe water’ cannot be considered equivalent to ‘access to improved water points’, which is the standard and currently accepted indicator for international monitoring that drives water supply policies in many developing countries.

3.5. The current problem of sustainability and the influence of technology

Chapter 5 addresses the effects that low sustainability can have on the success of national plans to increase services. This work was presented at the 1st IWA Development Conference (Jiménez and Pérez-Foguet, 2009c).

The RWSSP emphasizes the development of new schemes, and allocates just 6% of investments to rehabilitation and 4% to district management support and capacity building. This strategy was compared with the current water point functionality-time relationships found in an extensive water point mapping study conducted in three regions of Tanzania that account for 15% of the country’s total rural population. In this study, functionality-related and management-related water point mapping questions were disaggregated by both technological category and administrative structure, and appropriate scales of analysis of the various relationships were justified. The functionality by category showed that only 45.31% of hand pumps, 48.61% of gravity-fed systems and 44.36% of motorized systems were functional at the time of the survey. Some WP categories were found to be quite sustainable in some areas and to fail completely in others. Nevertheless, the statistical analysis showed a clear relationship between functionality and category of WP at supra-regional, regional and district levels.

The analysis found dramatically low functionality rates over time for all WP categories. In aggregate terms, hand pumps had the least favourable functionality-time function, dropping from 61% in the first five years to 8% in the 30-year period. Motorized systems started at 79% and dropped to 17% in the same period. Gravity-fed systems worked better in the long run than any other category of WP, dropping from 67% to 19%. In all three categories, just 35% to 47% of WPs were working 15 years after installation, and 22% to 38% of them stopped working before five years. RWSSP predictions estimate that 48% of people will be served by hand pumps, 25% will be served by motorized systems and 21% will be served by gravity-flow networks.

The latest data about the implementation of the pilot phase of the RWSSP (2002-2008) confirms the validity of this simulation (World Bank, 2008). Out of 197 water points examined in 19 sampled systems implemented in 6 districts over the last five years, 130 (65.99%) were functional at the time of the evaluation, with a 75% functionality rate for gravity and 55.91% for hand pumps. These values support the estimations made, and show that the functionality-time tendency has not changed with the current implementation model. Hence, urgent additional measures need to be taken to address sustainability.

3.6. The implementation of pro-poor policies in a decentralized context: the case of the RWSSP in Tanzania

Chapter 6 examines the challenge of achieving a balance between the implementation of centrally designed pro-poor policies and the decentralization of responsibilities to local governments in many developing countries. Specifically, we analyse the implementation of the Rural Water Supply and Sanitation Programme in Tanzania. The key mechanisms for planning and allocating resources are analyzed at ministry, district, and village levels.

The results show that a mixture of policy incoherencies, technical shortcomings and political influence determine that only a small proportion of funds reaches the underserved areas. Allocation of funds from Ministry level is quite transparent, but i) is too focused on the development of new infrastructures, with a low priority given to post-project support; and ii) is focused on efficiency rather than on territorial equity. Nevertheless, the greatest challenge to effective resource allocation is found at lower levels. District councils allocate projects based on a combination of need, demands (expressed in cash) and political influence. This tends to help bigger villages that are better connected and more influential, thus perpetuating existing inequalities. This situation is not counterbalanced by regular awareness creation and facilitation in the villages that are less organized or have worse connections. The dynamics of these districts are unlikely to change in the short term from the bottom level. Village planning, which is well-established in the country, receives only a small fraction of development funds (32.74% in 2007/2008). The quality of planning processes varies among villages. Villages and councillors are not sufficiently aware of other funding mechanisms, and only preselected villages are supported by the RWSSP to complete their applications and make initial contributions. In addition, villagers are ill-informed of application procedures and decision-making processes.

Hence, we conclude that greater intervention at central level is required if the objectives are to be achieved. As regards resource allocation, the improvement of territorial equity at district level should become an explicit target of the programme and be effectively included at all stages of its implementation. National directives could be given on a minimum level of service per ward and village, as occasionally occurs with other social services, even if this undermines the decision-making power of local authorities in the short term.

3.7. The role of local government

Chapter 7 builds on the role of the Local Government Authorities (LGAs), which must address the challenges of low sustainability and inequitable resource allocation. We focus on how LGAs can put into practice their responsibilities as delegated arms of the government, in order to achieve more equitable and sustainable water services. Results of the collaboration between ISF and a rural district in Tanzania from 2006 to 2009 were used as an action research case study that is representative of local capacity-building needs in decentralized contexts and rural areas. This work has been accepted for publication in the Natural Resources Forum (Jiménez and Pérez-Foguet, 2010a).

Three main challenges were detected at LGA level: i) the lack of reliable information; ii) the poor allocation of resources in terms of equity; iii) the lack of long-term district support to community management, which results in low sustainability. Two mechanisms were established: i) the use of the Water Point Mapping (WPM) as a tool for information and planning, and ii) the establishment of a District Water and Sanitation Unit Support (DWUS) to support community management.

WPM was included in a wider framework for the improvement of planning. Priorities based on objective data were defined using WPM, to reduce the influence of local politics. They were defined based on need, with territorial equity as the key driver, which was aligned with the non-exclusion principles of such a basic service. Additionally, the inclusion of demand creation into the LGA's activities was advocated, in order to prevent funds from being allocated only to the best prepared and organized villages. Hence, the focus was on providing support to underserved communities so that they can cope with the requirements. The use of WPM as a basic regular information system was also tested. The DWUS was designed by a multisectoral team, to assist in different aspects that threaten sustainability. Results obtained after one year show how strategies for equity oriented planning and post-project support can be implemented at local level.

CHAPTER 1

International investments in the water sector: last decade evolution and perspectives.

ABSTRACT

This chapter presents the main results of a detailed study carried out on Official Development Assistance (ODA) and international private investment in the water sector from 1995 to 2004. Publicly available data sets from the Development Assistance Committee (DAC), the World Bank, and the Human Development Reports were collected and stored in a database. ODA programmes were analysed individually to separate the water and sanitation subsectors. The study includes a comparative analysis of public and private international investment, focusing specifically on sanitation. It assesses the success of private participation in the sector and evaluates cross-cutting issues in ODA water programmes.

This chapter is based on

Jiménez, A., Pérez Foguet, A., (2009). International Investments in the Water Sector. *International Journal of Water Resources Development*, 25 (1), pp 1-14.

1. INTRODUCTION

In order to reach the drinking water and sanitation target of the Millennium Development Goals (MDG), it is essential that investments are appropriately allocated at every level. As mentioned in the literature (Fay et al., 2005; UN, 2005), access to such basic services is important in fulfilling other health- and poverty-related MDG. Despite the importance of this sector, there has been only a small increase in the availability of funds within it. Annual investments in water and sanitation in developing countries amounted to approximately 28,000 million dollars (including 14,000 for waste water treatment) during the mid-nineties (Briscoe, 1999; Global Water Partnership, 2000). Estimates for the contributions made by the each of the actors during that time (Camdessus, 2003) include 65-70% from the local public sector, 5% from the local private sector, 10-15% from international donors (including NGOs) and 10-15% from the international private sector. More recently, overall annual investment is reported to be slightly below 30,000 million dollars. However, the proportions invested by different sectors have indeed changed: international donors and NGOs have increased their annual commitments from around 3,900 to 5,500 million dollars (OECD, 2006) and international private sectors have reduced their contribution from 3,700 million dollars in the late nineties to less than 2,000 million dollars in the last four years (World Bank, 2006). The contribution of the local public sector is considered as, at best, stationary, since many developing countries have adopted economic plans that limit public expenditure, sometimes as a requirement to receive international aid. Reducing investments in infrastructure has been a normal mechanism to decrease public expenditure, while expecting the international private investment to cover it. This also explains the reduction in financial support from the World Bank for infrastructure in later years (World Bank, 2003). There has been an important growth in contributions within the local private sector of up to 4,300 million dollars per year. The increase in relative local private sector financing is due to their participation in operation and maintenance and the lack of response from national governments to demographic pressures, especially in large cities. Estimations of the evolution of sector financing is summarized in Figure 1.1.

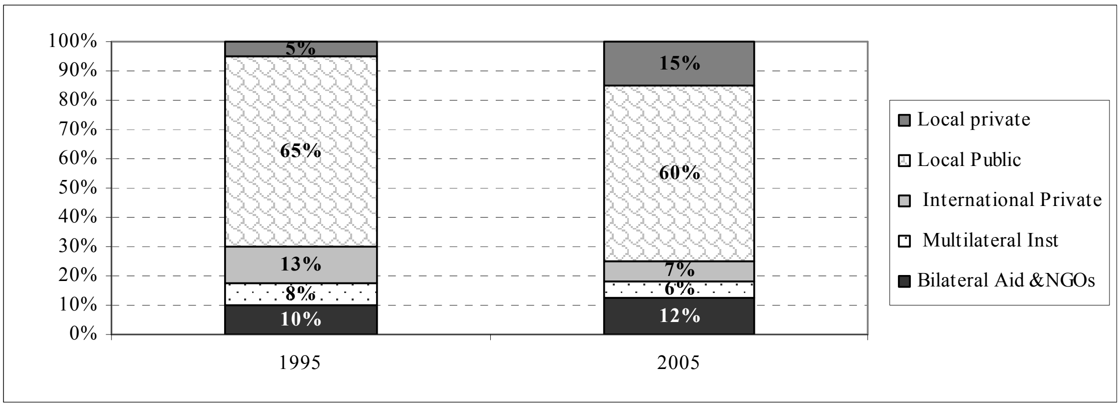

Figure 1.1. Estimation of water sector financing in developing countries. Comparison made between 1995 and 2005. Source: the author, from collected data.

The future could see an increase in contributions from Official Development Assistance (ODA). The OECD has committed to raising the amounts destined to aid with respect to 0.25% of GNI, which was registered in 2005 (Gupta et al., 2006); the fifteen wealthier countries of the EU have agreed to contribute 0.51% of their GNI in 2010, and 0.70% in 2015 (UN, 2005b). If these commitments are fulfilled, ODA could triple by 2015. Furthermore, the United Nations has declared 2005-2015 the International Decade for Action: Water for Life (UN, 2004). The Resolution states that the main goal should be a greater focus on water-related issues at all levels and on the implementation of water-related programmes in order to achieve internationally agreed water-related goals. Hence, a considerable increase in ODA funds dedicated to the water sector is to be expected even if there is no sign of it yet (Gurría 2007). A major challenge within the sector will be ensuring that international funds do not displace national investment. Since the biggest share of funds will be channelled through national governments there is a risk that they might reduce their own investments to benefit other politically prioritized sectors. Water funds should be somehow earmarked if total investment is to be increased.

However, estimates of the costs involved in reaching the MDG target for water and sanitation in 2015 differ considerably, ranging from 9,000 to 30,000 million dollars per year (Toubkiss, 2006). The most recent estimates on progress in reaching these goals reveal discouraging results: 55 countries are off track for the water target and 74 for the sanitation target (UNDP, 2006). With the actual gaining access rate, Sub-Saharan Africa would meet the water target in 2040 and the sanitation target in 2076. The investment required to achieve the MDG for countries with low access to services ranges from at least 1% of GDP to more than 2% of GDP (UN, 2005).

It is clear that operational and implementable water policies (Biswas, 2001; Biswas, 2008) combined with an effective allocation of resources are crucial in achieving targets. This includes financing coming from the international donors and also within each of the aid-receiving countries. General aid distribution patterns have been continuously monitored (Alesina and Dollar, 2000; Berthelemy and Tichit, 2002) and related to the achievements of the MDG (Baulch, 2006). The results reveal that the majority of aid, as a whole, remains politically driven. Meanwhile, as well as continent-specific analyses, particular sectors have carried out studies from the perspective of the aid-receiving countries (Mehta et al, 2005; Mwanza, 2003). The present study incorporates both perspectives. It analyses international contributions to the sector and relates them to the lack of services in each country.

Section 2 illustrates how all the data collected have been used to analyse resource allocation between 1995 and 2004. Section 3 presents the main results of the analysis, which include general, geographical, subsector and cross-cutting issues. Section 4 highlights the areas for improvement in the crucial forthcoming years.

2. METHODOLOGY

A database that incorporates information available to the public was compiled from the following sources:

- The Creditor Reporting System (CRS) from the Organization for Economic Cooperation and Development (OECD), which includes all official ODA operations from Development Assistance Committee (DAC) countries (OECD, 2007).
- The World Bank Private Participation in Infrastructure Project Database (World Bank, 2006).
- The United Nations Development Programme (UNDP) Database, from which population data and water and sanitation indicators were extracted (UNDP, 2007).

Disaggregated economic information from individual projects was used (11,743 from the CRS and 306 from the World Bank database), which enabled us to carry out a more thorough analysis that will be discussed later. The behaviour of individual donors was examined. A comprehensive analysis was carried out by including indicators for

population and water and sanitation in the database, thus that enabled us to compare levels of access with the investments received.
Despite being the most complete database for development action, the CRS does not permit the separate analysis of information regarding the allocation of funds for water and for sanitation. A description of the subsectors included in the CRS is provided in Table 1.1.

CODE	DESCRIPTION
14010	Water resources policy & administrative management
14015	Water resources protection
14020	Water supply and sanitation -large systems
14030	Water supply and sanitation - small systems
14040	River development
14050	Waste management/disposal
14081	Education and training in water and sanitation

Table 1.1. Creditor's Reporting System (CRS) description of Water and Sanitation subsectors. Source: DAC (2002).

To separate ODA's fund allocation for water and sanitation, codes 14020 and 14030 must be further divided. For our analysis, all programmes reported under these two codes were separated into three categories: water, sanitation and mixed (water and sanitation combined). In order to reclassify these programmes, we used the information provided for each of them in their short descriptions. This revealed the actual efforts of donors aimed at water and sanitation; we were also capable of comparing this information with private investment, as is described in Section 3.6.
Moreover, the CRS does not include private transactions from countries that do not belong to the DAC or donations from private agencies that do not provide information regarding their geographical distribution. These data are obtained from donor reports.
The database for the World Bank regarding private participation in infrastructures includes contract type, the amount of the investment and the main actors involved. The information is compiled from commercial databases, specialized publications, companies, and web resources from multilateral organizations. Therefore the total amounts given are estimates. Data refer to commitments, not disbursements, and include

the whole investment foreseen, even if a part of the investment is not private. The database is updated with public information available regarding renegotiated contracts.

3. RESULTS AND DISCUSSION

This section highlights and discusses the main results of the analysis using the following categories:

3.1. Overall trends
3.2. Terms and conditions of official aid compared to OECD recommendations
3.3. Coordination among donors
3.4. Investment in sanitation
3.5. Integrated approach of ODA-financed water and sanitation projects
3.6. Complementarities between public and private international investment
3.7. Success of international private participation

3.1. Overall trends

Between 1995 and 2004 the total contribution of ODA increased moderately (33%), whereas the trends for contribution to those projects from private participation were irregular; there was a large increase at the end of the nineties followed by a sharp decline after 2001. Water sector accounted for 5 % of total ODA as well as 5 % of total private investment in infrastructures. ODA investments for water sector have been mainly descendant during the decade. Due to an increase in commitment in investment from 2002, the year 2004 saw the highest investment rate of the decade, but not by much (5,609 million dollars in 2004 compared to 5,435 in 1997). Accumulated commitments amounted for 46,360 million dollars, 27,870 of which originated from bilateral donors and 18,490 from multilateral institutions (Figure 1.2).

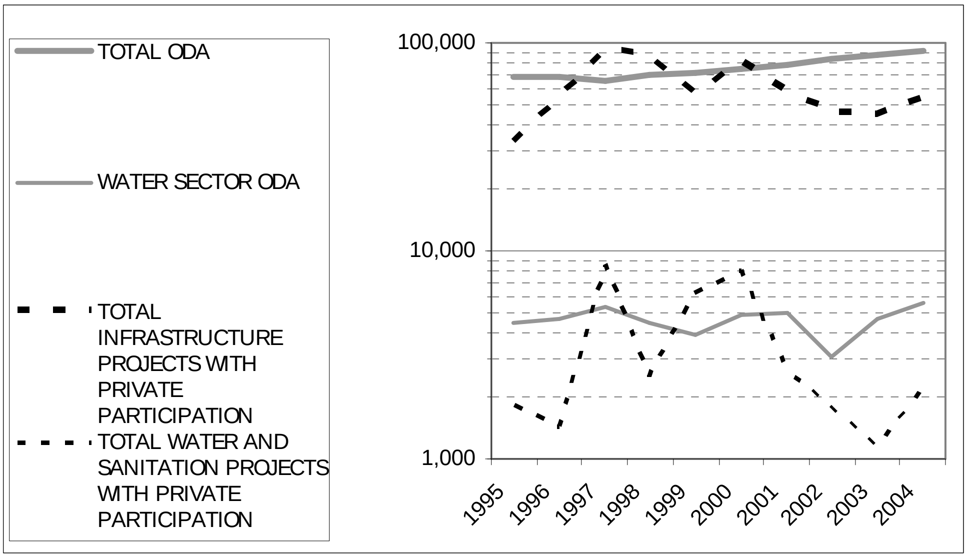

Figure 1.2. Evolution of ODA and private participation in infrastructure projects. Amounts in millions of dollars (2004). Source: the author, from CRS and World Bank data.

Projects with private participation amounted to a total of 36,280 million dollars. However, this figure does not reflect actual private investment because, as previously explained, the World Bank database includes the total cost of the operation, even if other actors as well as private ones are involved. When estimates are made including only the share of private participation, the result is 26,841 million dollars. The amount dedicated to infrastructure is 23,432 dollars, and the remaining money is invested in the purchase of licenses and administrative costs. Another point to consider is that the database is not updated when changes in contracts occur, unless the renegotiation is made public. Given the conflicting nature of private participation (see the detailed analysis in Subsection 3.7), with 28% of investments cancelled or in distress (where the government or the operator has either requested contract termination or are in international arbitration), it is reasonable to estimate actual commitments between 1995 and 2004 at approximately 18,000 million dollars. In addition, most of the contracts are long-term operations (up to 50 years), while ODA programmes rarely last more than 8 to 10 years. This is important when one is considering the real disbursements of both types of investors.

3.2. Terms and conditions of official aid compared to OECD recommendations

The analysis of terms and conditions of the aid delivered reveals contradictions regarding donor's own recommendations. Reported tied aid represented 9% of the transfers during the period of analysis. It is also important to highlight that 16% of bilateral funds did not report this aspect. This lack of reliable information is surprising, considering that specific agreements on reducing tied aid were made long ago (DAC, 1987, 1992).

During the period of analysis, only 33.5% of all the aid devoted to the sector comprised grants. Loans are examined through their "grant element". This concept reflects the financial terms of a transaction: interest rate, maturity (interval to final repayment) and grace period (interval to first repayment of capital). It is a measurement of the concessionality (softness) of a loan. It is defined as the difference between the face value of a loan and the discounted present value of the service payments to be made by the borrower over the lifetime of the loan, expressed as a percentage of the face value (DAC, 2002). The reference rate of interest for calculating the grant elements is fixed at 10%.

For the decade studied, there was a 62.12% grant element; 81.53% for bilateral transactions and 32.16% for multilateral ones. As a reference, the DAC agreed to have an overall ODA grant element of at least 86%, increased to 90% for Least Developed Countries (DAC, 1978). Four of the five most important donors in the sector (Japan, Germany, the European Union and France), which combined provided 67.65% of bilateral aid, have very low concessionality rates: 72.89%, 87.93%, 70.55% and 65.70%, respectively. Of this top five, only the USA provided a good grant element (100%). Loans given by multilateral banks on commercial terms do not comprise a grant element; this represents 59.88% of all multilateral transfers during the study period. The terms and conditions of the aid provided are summarized in Figure 1.3.

<table>
<tr><td colspan="6">WATER AND SANITATION OFFICIAL DEVELOPMENT ASSISTANCE: 4.636 MUSD/year</td></tr>
<tr><td colspan="4">BILATERAL DONORS(60%): 2.787 MUSD/year</td><td colspan="2">MULTILATERAL(40%): 1.849 MUSD/year</td></tr>
<tr><td>TIED (9%)</td><td colspan="4">UNTIED OR PARTIALLY TIED (75%)</td><td>NO REPORT(16%)</td></tr>
<tr><td colspan="2">NOT REFUNDABLE: GRANTS (33,5%)</td><td colspan="4">REFUNDABLE: LOANS (66,5%)</td></tr>
<tr><td colspan="4">GRANT ELEMENT (62 %)</td><td colspan="2">NOT CONCESSIONAL FUNDS (38%)</td></tr>
</table>

Figure 1.3. Terms and conditions of ODA in water sector. Average for 1995-2004 study period. Source: the author, from collected data.

3.3. Coordination among donors

The current efforts of donors are focused on improving general aid efficiency through alignment and coordination at the national level in aid-receiving countries (EU, 2006). However, there has been no coordination among donors to set priorities based on the needs of individual regions. As a result, politically important regions might receive more aid (regardless of their level of service), while other more disadvantaged areas are ignored.

With regard to the water and sanitation sector, no correlation was found between the amount of aid received and the number of people without service living there. Figure 1.4 presents the percentage of investment per region during the period studied. The South-central Asia region (including India) hosts 45.19% of all people living without access to basic sanitation and 34.57% of all people without access to water; despite this, however, it only received 14.87% of investments. Sub-Saharan Africa hosts 26.77% of people without access to water and 16.68% of those without sanitation, and it received 17.42% of total investments. East Asia (including China) received a more even treatment: it hosts 28% of all people without access to the two services and received 23.99% of investments. Those regions better treated by donors include Central and South America, where only 5% of people without access reside and which received 17.91% of investments; similarly, North Africa and the Middle East, which host less than 2% of the world's population living without access to water and sanitation, received around 10% of sector's investment.

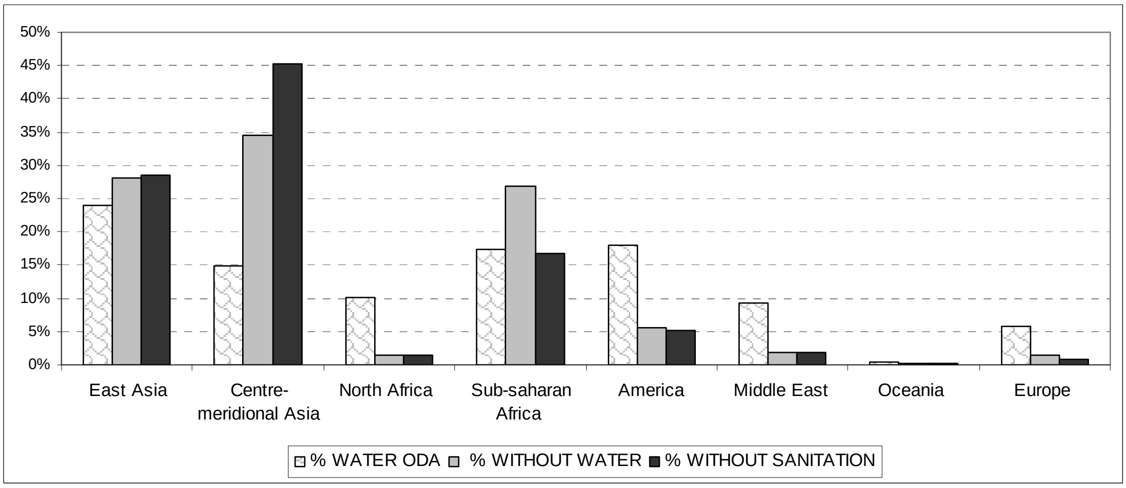

Figure 1.4. Share of ODA received in 1995-2004 compared with the share of people without access living in that region (access data from 2002). Source: the author, from collected data.

3.4. Investment in sanitation

The estimated average figure for access to water and sanitation facilities on a global scale is 79% for water and 48% for sanitation (UNDP, 2007). To assess how consistent donors were in allocating funds within the sector, the share of funds that each donor gave to countries with less than 80% of access to water and less than 50% of access to sanitation was examined. By using access to water as a criterion, the share of funds allocated to countries under the global average for access amounts to 71.23% of all bilateral and 78.65% of multilateral funds. If we regard access to sanitation as a criterion, the share of funds allocated to countries below the global average for access falls to 36.88% of bilateral and 47.02% of multilateral funds. From the five most important donors in the sector, Japan and France dedicated their efforts to water by allocating 77.48% and 77.45% of their funds to countries with access levels below the average. Germany invested 67.14% of their funds in water-deprived countries, and 35.75% in sanitation-deprived. The European Commission allocated 56.96% of its funds to water-deprived and 27.26% to sanitation-deprived, and the United States dedicated 46.83% to water-deprived nations and 2.92% to those countries under world's average access to sanitation. None of the bilateral donors dedicated more than 75% of their funds to sanitation-deprived countries, and in all cases water-deprived countries received a larger proportion of funds than did those deprived of sanitation facilities. Our research revealed that of the three most important multilateral donors the International

Development Association (IDA) was the one that performed the best: it allocated 95.47% of funds to water-deprived countries and 78.53% to sanitation-deprived ones.
During the study period, 63% of ODA was dedicated to subsectors 14020 (large water supply and sanitation systems) and 14030 (small water supply and sanitation systems). Bilateral and multilateral donors dedicated 75% and 49% to these subsectors, respectively. If we deepen the analysis by dividing these subsectors into three categories (water, sanitation and mixed), as we explained in Section 2, the results confirm the general overview that sanitation is not being a priority. Figure 1.5 represents the five most important donors (covering 77% of total bilateral funds dedicated to the sector) and the share of funds invested in each of the three categories mentioned. The rest of the donors and multilateral aid were aggregated.

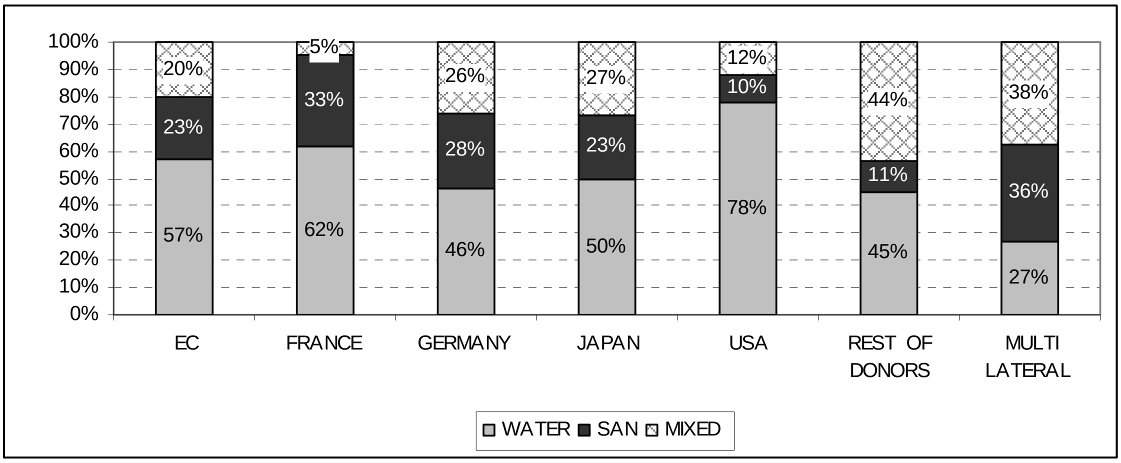

Figure 1.5. Share of funds (from subsectors 14020 and 14030) invested by bilateral and multilateral donors to access-oriented water, sanitation or mixed (water and sanitation) projects. Source: the author, from public data, as explained in main text.

All of the bilateral donors (with the exception of Portugal and Sweden) and the most important donors (Figure 1.5) dedicated more funds to water programmes than to sanitation. The average investment from bilateral donors was 2.41 times higher in water projects than in sanitation. The proportion dedicated to water projects was 39.14%. This share, as well as being larger than for sanitation, was also larger than the investments made in mixed projects (36.21%). Our analysis revealed donations made by multilateral donors to be more equally spread; however, the share of aid dedicated to the aforementioned subsectors was significantly lower (49%). Globally, in terms of the aid dedicated to subsectors 14020 and 14030, 43.13% was invested in water projects, 26.50% in sanitation projects, and 30.37% in mixed projects.

3.5. Integrated approach of ODA-financed projects

The integrated approach refers to the goals of "gender equality", "environmental orientation" of actions, "poverty focus", and "good governance and participatory orientation", as defined by the Development Assistance Committee (DAC, 2000). Donors qualify as "principal", "significant" or "not considered" the project's implication with each of the cross cutting issues mentioned. The results of the 11,743 projects analysed are shown in Table 1.2.

Aspect	Principal or significant	Not considered	Not reported
GENDER	11.77%	29.36%	58.87%
ENVIRONMENT	32.87%	10.60%	56.53%
POVERTY FOCUS	9.59%	13.36%	77.05%
PARTICIPATION	100.00%	0.00%	0.00%

Table 1.2. Share of funds allocated depending on their score against cross-cutting issues, as explained in main text. Source: the author, from collected data.

The most important result found upon analysing these aspects was the lack of data provided by donors, which compromises reliable interpretation. This could be the result of reluctance on the part of donors to report that these aspects have not been adequately considered; it could also be that DAC definitions are too vague. Gender was only reported as principal or significant in 11.77% of the cases, and environment in 32.87% of them. Less than 10% of projects were reported to be poverty-focused, and 77.05% of projects did not report on this aspect. In terms of participation aspect, not a single project reported it as principal, but all of them did it as significant. Regardless of this, our results indicate that these subjects tend to be ignored during the drafting of project reports. Consequently, we suggest that DAC should insist on a more rigorous reporting from their members regarding such crucial issues.

3.6. Complementarities between public and private international investments

Regarding the income level of aid-receiving countries, bilateral donors contributed 44% of their resources to low-income countries and 53% to medium-income countries. Multilateral institutions dedicated 54% and 45% to low- and medium-level income countries, respectively. A total of 98% of the money invested in projects with private participation was destined to medium-income countries, while Africa attracted only 0.95% of it. Figure 1.6 displays the results of this assessment, organized by continents, and represents the annual investment per person living in those regions. In Asia the combined contribution from the public and private international sectors is meaningful, since that is a region with a large number of people living without services and receiving low rate of aid per capita (Figure 1.4). Otherwise, public ODA contributed to (and sometimes co-financed) private investment in Europe and Central and South America. As previously mentioned, the private sector was almost absent from Africa.

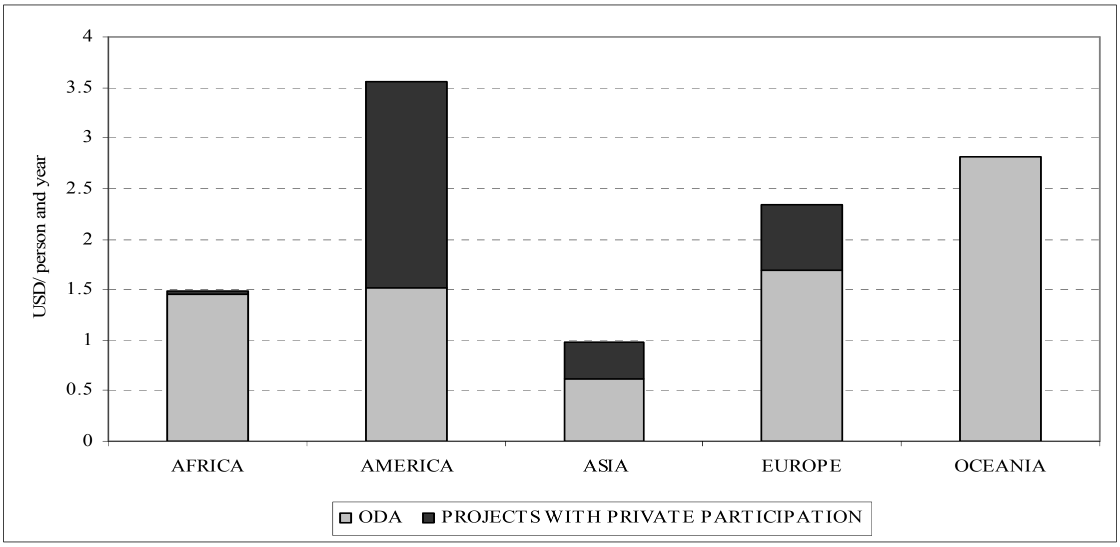

Figure 1.6. Public and private international investment per capita in water and sanitation, organized by continent. Average for the 1995-2004 study period. Source: the author, from collected data.

In terms of fund allocation in subsectors, large water supply and sanitation systems received 56.32% of total ODA funds (bilateral and multilateral), followed by 17.16% for water resource policies and administrative management. Small water supply and sanitation systems received 13.13% of funds. River development projects received substantial support at the end of nineties; however, the average for the study period was only 6.06%. The remaining subsectors (water resources protection, waste management and disposal, education and training in water and sanitation) received less than 4%, with only 0.38% given to education and training. Compared to bilateral donors, multilateral institutions focused more on policy issues (25.05%) and paid very little attention to small systems (3.75%) and training (0.07%). The Millennium Declaration has boosted funds engaged in small systems (65% of funds for the subsector were committed after 2000); however, investment in large systems represent over 50% of investments from multilateral and bilateral donors between the period of 2000-2004 despite the lack of services in the rural areas: 72% access to water and 38% access to sanitation, compared to the urban situation of 92% and 76%, respectively (UNDP, 2006).

By representing the allocation of funds to subsectors from ODA (through the modification explained in Section 2) compared with funds invested by projects with private participation (Figure 1.7), we observe each actor's contribution in terms of access-oriented projects (water access, sanitation and mixed projects). ODA funds engaged in these three categories amounted to 33,808 million dollars, while those benefiting from private participation amounted to 26,040 (discounting cancelled or distressed investments, as explained in Section 3.7). It must be considered that real private investment engagement was lower. Figures represent total project costs (including other participants' contributions, such as those of multilateral institutions or national governments). Real private investment will be more slowly disbursed, since contract periods are much longer than ODA programmes, as it has been previously explained. Private investment seldom focused on sanitation operations; the majority of private funds were dedicated to mixed projects and involved the more attractive water supply subsector. Consequently, the addition of public and private investment gives priority to mixed projects (23,683 million), closely followed by water (23,658 million dollars), and doubles funds dedicated to sanitation projects (11,011 million dollars).

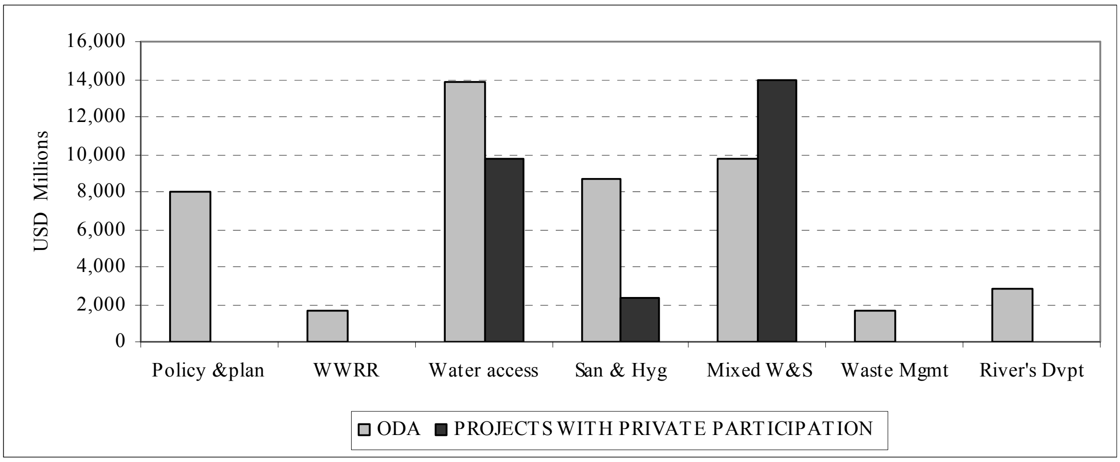

Figure 1.7. Public and private international investment per subsector (1995-2004), in millions of dollars from 2003. Source: the author, from collected data, as explained in the main text.

In terms of the size of projects, there are big differences between public and private actors: 61.33% of private investment was directed at 145 mixed projects (water and sanitation) with an average investment of 153 million dollars; 31.20% was invested in 102 water projects, with an average amount of 111 million dollars; and 7.47% was invested in 59 sanitation projects, with an average sum of 46 million dollars. Regarding ODA, 3167 large operations (code 14020) and 3503 small ones (code 14030) were reported, with an average investment of 8.24 million dollars and 1.74 million dollars, respectively.

3.7. Success of international private participation

At the time of this study, 37 projects with international private participation amounting to 10,143 million dollars were cancelled or in distress (where the government or the operator has either requested contract termination or are in international arbitration), i.e. 28% of investment engaged during the study period. The most significant cases for regional trends include East Asia, with 16.98% of projects and 31.41% of the investment (4,856 million dollars) suffering from cancellation or in distress. Latin America and the Caribbean region saw 12% of projects and 32.17% of investment (5,278 million dollars) in that situation. Data reveals that large concession projects were the most conflictive, especially in the water supply subsector (17% of projects cancelled or in distress), as shown in Figure 1.8.

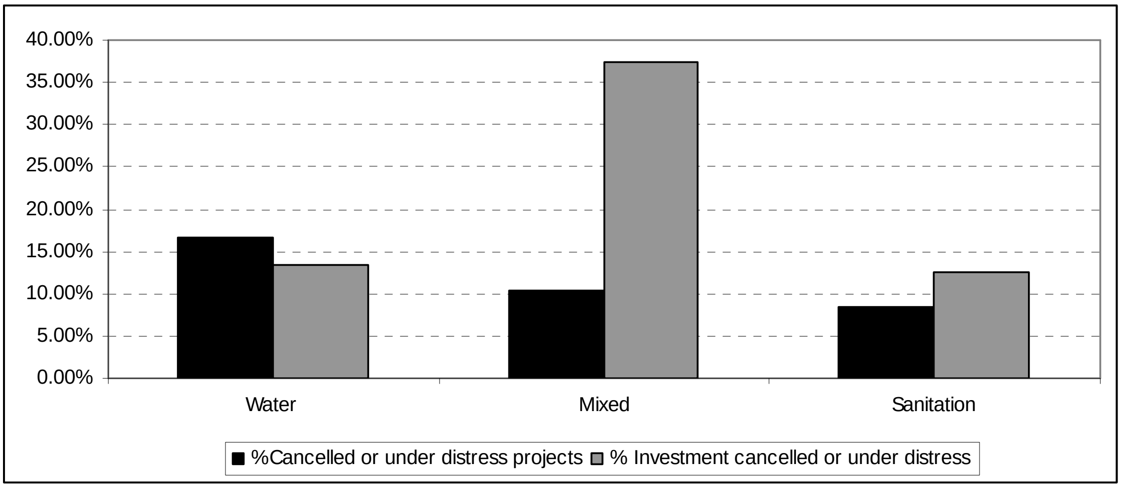

Figure 1.8. Cancelled or in-distress private participated projects in the water sector (1995-2004 study period). Source: the author, from World Bank data.

4. CONCLUSIONS

The effective allocation of investments is vital if the Millennium Development Goals (MDG) target for water and sanitation is to be achieved. The study of the period 1995-2004 reveals interesting and also discouraging results regarding international participation in water and sanitation sector. First, the reporting systems are not coherent. Private and public investments are not easily comparable, since distinctions such as geographical regionalization and subsector divisions are not coherent. An important point is that CRS only divides access-oriented projects into "large" or "small", and does not make the distinction between water and sanitation subsectors.

Our analysis of ODA demonstrates how far donors lag behind their own commitments both in terms of quantity and quality of the aid delivered to the sector. In terms of quantity, during the 2000-2004 period donors and multilateral institutions only committed 50 million dollars a year more than in the 1995-1999 period, despite the Millennium Declaration. Data show large geographical inequalities when the share of aid received by regions is compared to the number of people without access living there and demonstrates the lack of coordination among donors to set priorities. The results of individual analysis were no more encouraging. Some of the most important donors in the sector (Japan, the European Commission, Germany and France) scored a very low performance based on the terms and conditions of aid provision. With regard to the allocation of funds in subsectors, the majority of funds were dedicated to large systems, both by multilateral and bilateral donors. This is particularly unsettling considering the lack of access that rural populations suffer and the supposed poverty-orientated tendency of ODA.

Despite extremely low investment in sanitation, none of the bilateral donors dedicated more than 75% of their funds to sanitation-deprived countries, and consequently water-deprived countries received a bigger share of funds than did those lacking sanitation. The average investment from bilateral donors was 2.41 times more in water projects than in sanitation projects. Investment in water projects (39.14%) was larger than in sanitation and mixed projects combined (36.21%).

Although it is a comprehensive database, the Creditor Reporting System (CRS) is currently not being filled in rigorously enough by donors. Crucial aspects in development programmes such as gender, beneficiary participation, the environment and poverty focus are widely overlooked and frequently absent from reports.

International private participation in water and sanitation projects show little contribution to the achievement of the MDG: 98% of investment was dedicated either to medium- or high-income countries and mostly oriented towards mixed projects costing over 100 million dollars each; meanwhile, Africa benefited from only 0.95% of the investment during the study period. Simultaneously, private participation has been rather conflictive, with 28% of the investment engaged during the study period being cancelled or in distress, and it is decreasing in latest years,. Few complementarities were found between international public and private investment from the perspective of the people without access, since the biggest aggregated investment per capita was destined to America, Europe and Oceania, which are the continents with the lowest number of people without access to water and sanitation.

Based on our analysis, we can confirm that aid was insufficient, of low quality and poorly targeted, from both geographical and sectoral perspectives, during 1995-2004. Quantity commitments until 2015 have already been agreed on from most OECD donors. Current efforts and debates are focused on improving general aid efficiency, through alignment and coordination at the national level in the aid-receiving countries. However, the water MDG requires a broader approach: a global coordination mechanism among donors to encourage needs-based resource allocation. It is also important that donors fulfil their own recommendations regarding the terms and conditions of aid provision. International water and sanitation funds should contribute to existing national funds to effectively increase sector investment and prevent national governments from shifting their own funds to other sectors. It is an objective of ODA to fight poverty and for this reason there should be more focus on deprived (rural) areas and subsectors. The tiny amount of ODA resources dedicated to sanitation massively contradicts current requirements.

CHAPTER 2

Monitoring Water Poverty: A Vision from Development Practitioners

ABSTRACT

This chapter presents an analysis of the available methodologies at international level for measuring water poverty and water access. Results show that they show some drawbacks when applied to practical tracking of the water sector performance. A case is made in this chapter for the adoption of EASSY (**E**asy to get at local level, **A**ccurately defined, **S**tandard and internationally applicable, **S**calable at all administrative levels, **Y**early updatable) variables locally collected for monitoring water and sanitation sector. Implementing EASSY indicators will certainly require a proper definition from the scientific community and academia, the involvement of donors and civil society, and government willingness to implement measures to collect them.

This chapter is based on

Jiménez, A., Molinero, J., Pérez-Foguet, A. (2009). Monitoring Water Poverty: A vision from development practitioners. In *Water Ethics*. Marcelino Botín Water Forum 2007. ISBN- 13:978-0-415-47303-3.

1. INTRODUCTION

This chapter tackles the challenge of analyzing the current status of monitoring water poverty in developing countries. The economic study of the current state of water and sanitation sector is addressed in Section 2, and a demonstration is provided as to the need for proper monitoring of water sector performance at the national level. Neither traditional indicators of water supply access are able to provide a sound methodology for water sector monitoring, as it is shown in Section 3. An analysis of characteristics of *Water Poverty Index* (WPI) (Sullivan, 2002; Lawrence *et al.*, 2002) for tracking the water and sanitation sector in developing countries is made in Section 4. The relationship between water poverty, human development and human poverty is analysed and it is seen that, even though WPI is the best tool available nowadays for measuring water poverty, it is still not appropriate for tracking the performance of water sector at the national level. Appendixes containing the detailed statistical analyses in which the conclusions are based in are included at the end of the chapter. Finally, the chapter ends with a discussion where it is concluded that there is a urgent need of EASSY (**E**asy to get at local level, **A**ccurately defined, **S**tandard and internationally applicable, **S**calable at all administrative levels, **Y**early updatable) variables for the sector, which could be included in sector information collection routines in low income countries. It is firmly believed that all stakeholders such as academia, governments, civil society and donors should reach a consensus as to the adoption of the above mentioned EASSY indicators.

2. THE IMPORTANCE OF MONITORING WATER SECTOR PERFORMANCE

With the background described in previous chapters, it is to be expected that funds for water sector channelled through national governments in aid recipient countries will increase. In practical terms, at least 85% of aid flows will be reported on government's budget and will use public financial management systems (*Paris Declaration*). That will lead to the fact that the great part of aid will be channelled through sectoral or general budget support, thereby considerably increasing the concerned ministry's budgets. According to our estimates (chapter 1), this means that around 70% of total financing for the water and sanitation sector in those countries, and around US$ 20,000 million a year will be channelled through national governments.

This context highlights a very important problem for NGO and development agencies in the field, namely, how to monitor national government's policies in a short term basis to ensure an effective expenditure of funds. Research evidence shows that so far budget support has not improved national accountability significantly (de Rienzo, 2006). As an example, the last revision of the Global Budget Support for Tanzania (years 1995-2005), states that "poverty impacts remain uncertain for the last half decade, the most relevant period, because there has been no household survey since 2001" (Lawson and Rakner, 2005). Thus, the ability for tracking the performance of national governments remains crucial to fight water poverty and increase access to services, water and sanitation included.

Sectoral Budget Support such as water or health is usually based on annual reviews done jointly by donors, government and other actors (private, civil society) where performance is to be assessed. The main problem is the inexistence of reliable and objective indicators to make this assessment. Continuing with the same example as above, *Joint Water Sector Review* in Tanzania 2006 occurred without having a set of appropriate indicators and therefore, being impossible to measure results. A too big time-lag between funds disbursement and outcome measurement should be avoided, since that would prevent political accountability regarding poverty reduction decisions. That is why, from development practitioners' perspective, there is a strong need to set international indicators that fulfil some requirements:

- Sensitivity in short term period, that allows performance monitoring.
- Possibility to be measured in a bottom-up approach, allowing the establishment of regional trends.
- Easy to measure and cost-limited, allowing those to be integrated in the sector information system in low income countries.

3. TRACKING WATER SECTOR PERFORMANCE USING MDG INDICATORS

The most important monitoring task in the water sector is being carried out at the international level by the WHO and UNICEF *Joint Monitoring Programme for Water*

Supply and Sanitation (JMP), whose main goal is to track the fulfilment of the *Millennium Development Goals*. The target being "to halve by 2015 the proportion of people without sustainable access to safe drinking water and basic sanitation" (UN, 2003; WSSD, 2002), the most suitable indicator for it is the number of people having "access to improved" water sources (WHO/UNICEF, 2000, 2005). Improved and not improved sources are defined in Table 2.1.

	Improved	**Not improved**
Water supply	Piped connection into dwelling, plot, or yard	Unprotected well
	Public tap or standpipe	Unprotected spring
	Borehole	Vendor-provided water
	Protected dug well	Bottled water
	Protected spring	Tanker truck–provided water
	Rainwater	River, stream, pond, or lake

Table 2.1. Improved and not improved water sources (WHO/UNICEF, 2005).

According to the *Water Supply and Sanitation Collaborative Council* (WSSCC) task force, people are said to have access to improved water supply if they have access to sufficient drinking water of acceptable quality, as well as sufficient quantity of water for hygienic purposes.

There are several examples of how these definitions can be differently interpreted. Only recently have countries like Mozambique recognized rope pump water points as *improved access* (WaterAid, 2005), even if it fits into the definition given above. In rural Tanzania, "the basic level of service for domestic water supply in rural areas shall be a protected, year-round supply of 25 L/day of potable water per capita, through water points located within 400 m from the furthest homestead and serving 250 persons per outlet" (GoT, 2002). However, this very water point would serve 500 people in a radius of not more than 500 m in Mozambique (GoM, 1995). On the other hand, whatever the definition, access is usually calculated through household surveys, thus including personal interpretation about what *access* means and therefore not as objective as police provisions say. Much more could be discussed about this issue, since the coverage figures produced by technology indicators do not give enough information about the quality of the water provided or about its use (WHO/UNICEF, 2000). Similar analysis could be made with the indicator for sanitation access, but many of its limitations and drawbacks are described elsewhere (WHO/UNICEF 2005). Then, even though these are the most widely used indicators relating to water and human poverty, as the above examples show, they have not proven to be accurate enough, leading to difficulty in interpretation of available figures. Independently of the results provided by this short analysis, tracking water sector policy and performance is not only related to access, but to several other aspects that need to be measured, as *Integrated Water Resources Management* approaches indicate (European Union, 2006). Next Section focuses on the characteristics of *Water Poverty Index* (WPI) for that purpose.

4. TRACKING WATER SECTOR PERFORMANCE AT NATIONAL LEVEL USING WPI

WPI is an aggregated indicator with a broader scope than those of MDG, defined by a large number of scientists in consultation with concerned stakeholders (Sullivan *et al.*, 2003). It contemplates five subcomponents: *Resources*, *Access*, *Use*, *Capacity* and *Environment*, thus being a much more comprehensive approach ever used for measuring water poverty.

This section deals with the applicability of the index for water sector monitoring at the national level through two different approaches:

- Section 4.1 and 4.2 show the results of an analysis of the relationship between WPI and the most relevant country development indicators, such as the *Human Development Index* (HDI), the *Human Poverty Index* (HPI), the *Gross Domestic Product* (GDP) per capita expressed in *purchasing power parity* (PPP) in current international dollars, and the *Falkenmark Index* (FI). This provides an overview of the added information provided by WPI, as well as new ideas for its definition. Section 4.3 studies the ability of WPI index to differentiate among countries in terms of key indicators. Some limitations are identified: narrow ranges of variation and population concentration (especially the in the *Environment* subcomponent of the WPI). Detailed analysis is presented in the statistical annex.
- Section 4.4 makes an overview of WPI applications at different scales, including an analysis of key issues identified for monitoring use.

4.1. Water Poverty and Human Development

This subsection is intended to provide insight into the relationship between *Water Poverty Index* (WPI), and *Human Development Index* (HDI). Detailed figures are provided in Appendix 1.

The relationship between WPI and HDI has been pointed out recently (Mukherji, 2006). The author concluded that the water poverty of a nation is not related to water scarcity but, rather, with the development level and per capita GNP. As analysis shows, there are many different HDI situations for a given value of the WPI resources index. This confirms that the initial conditions in terms of water resources have not been significant for countries development.

According to the WPI methodology (Sullivan, 2002; Lawrence *et al.*, 2002), the sub-index of resources is computed by taking into account internal water resources and external water inflows in each country. Resources are expressed on a per capita basis (Lawrence *et al.*, 2002). However, as pointed out by Sullivan *et al.*, (2003), the variability of water resources is a factor that is often overlooked in water and poverty analyses. The key factor on defining the contribution of resources in the overall water poverty of a given community (both at national or local scale) should be the *actual resource availability* rather than the quantity of water resources. Water is fugitive (Savenije, 2002) and either costly infrastructures or good hydrogeological conditions are required for water storage. This is why an interesting relationship to be studied would be the one existing between WPI and exploitable water resources (instead of total water resources). Exploitable water resources are defined as "the water resources considered to be available under specific economic and environmental conditions" (FAO, 2003). The computation of exploitable water resources contemplates factors such as dependability of the flow, extractable groundwater, and minimum flow required for non-consumptive use. Unfortunately, estimations of exploitable water resources are not easy and needed data are only available for a limited number of countries in the AQUASTAT database (FAO), most of them being either developed countries or developing countries of semi-arid or arid regions.

Traditionally, the key indicator for water poverty is the access to *improved* sources of water. *Access* is the second sub-index integrated to the WPI methodology, accounting for three indicators, namely, *percentage of safe water access*, *percentage of sanitation* *access* and an *index of irrigation* (Lawrence *et al.*, 2002). Analysis shows (see Appendix 1) that there is a fair linear relationship between HDI and WPI *Access* sub-index, with a correlation coefficient of 0.75. Extreme poverty cannot be overcome without adequate access to water (Sullivan *et al.*, 2003), so this relationship between HDI and WPI *Access* appears to be meaningful.

The WPI *Capacity* sub-index is the one which shows the best relationship versus HDI, with a correlation factor of 0.88 (see Appendix 1). Quantitative indicators for the *Capacity* sub-index are: *GDP per capita*, *under-5 mortality rate*, *UNDP education index* and *Gini coefficient* (Lawrence *et al.*, 2002). Then, the high degree of correlation between WPI *Capacity* and HDI can be expected since the sub-index is based on the same data that contribute to the HDI. It is obvious that assessing the capacity of people to manage their own water resources is crucial for a sound assessment of water poverty. However, a discussion could be opened as to whether current WPI *Capacity* sub-index is really giving added information to the WPI or just mimicking HDI. It is worth noting that no specific information about water sector itself is considered for WPI *Capacity* estimation at a national level. Data such as the number of water technicians per capita, the people with university degree in water sector, or the number of water management entities could perhaps enhance the *Capacity* sub-index by adding sector-specific information.

No relation is found between WPI *Use* sub-index and HDI (see Appendix 1). Misuse of water is common in some developed countries (e.g. Spain scores 9.8), and some medium and low HDI countries can score better in this factor, like Sudan (14.6) or Mauritania (14.3). Mukherji (2006) found a direct relation between WPI *Use* sub-index and per capita GNP to a given threshold (about US$ 10,000 PPP), after which the relation become reverse as a possible indicator of efficiency achieved after a certain level of development.

Values of the WPI *Environment* sub-index display considerable scatter when plotted against HDI (Appendix 1). It is seen that only highly developed countries are able to score high values (i.e. 14 or above) in this factor (in particular, those of temperate and humid climatic conditions, as can be derived from a closer look at the WPI database), while almost every situation is possible under a value of 13. There is a clear *preference* of countries to get 11 points, whatever their level of development (Appendix 1). As a consequence, no clear conclusion about environmental conditions and its relationship with poverty or development appears to be possible below a WPI value of 13.

Further analysis of HDI–WPI relationships has been performed using Factorial analysis with the same dataset used previously by Mukherji (2006). A detailed presentation of the analyses done is shown in Appendix 2. Main results show the follows: First, it is worth stressing that *Use*, *Environmental* and *Resources* components of WPI contribute in a similar amount to the description of the variability of the dataset. *Capacity* and *Access* components, which are highly correlated, contribute also in a similar amount; however, both contribute in the same factor. Specific contribution of *Access* component of WPI has been found, but marginal. Almost null contribution of factor specifically related with *Capacity* component has also been found.

It is also remarkable the high correlation between *Capacity* component of WPI and HDI. This could be used in two different manners. Firstly, as an argument to redefine that component, provided that the results are almost identical to the HDI itself. Note that this supports the previously introduced notion that the *Capacity* component should be revised in order to include specific information related to water and sanitation sector. And conversely, provided that HDI and *Capacity* component are so much correlated at state level, HDI distributions at smaller geographical scales (local, regional, etc.) could be used to approximate *Capacity* component at those scales if other data is unavailable. Although the correlation using data at other scales has not been checked, the hypothesis seems reasonable. The same analysis could be applied to *Access* component of WPI and HDI, however it is worth noting again that *Access* component contribution is small but much higher than that associated to *Capacity* component (compare sixth and seventh unrotated factors in Table 2.3 of the Appendix 2).

Finally, another result of the analysis concerns the contribution of *Falkenmark Index* (FI), introduced in the analysis following a previous work by Mukherji (2006). It can be concluded that the correlation between *Falkenmark Index* and *Resources* component of WPI is strong enough to consider only one of both at a first level description. In that situation more than 90% of the variability of the overall system is kept, and variability of all variables is explained in, at least in 85% of cases. However, for a detailed comparison between countries, its inclusion could be considered, as it provides more information about the variability of the system than, for instance, *Access* or *Capacity* components (especially if HDI is available).

4.2. Water Poverty and Human Poverty

Relationship between WPI and the *Human Poverty Index* (HPI) has been analysed with factorial analysis, following same steps of previous subsection (Appendix 3). Also the decimal logarithm of the *Gross Domestic Product* (GDP) per capita has been included.
Results show that the inclusion of logarithm of GDP and HPI modifies neither the statistical behaviour nor the conclusions of the analysis of just WPI and HDI presented in previous subsection. On the other hand, logarithm of GDP, has the same behaviour as HDI, consequently it shows also a high correlation with *Capacity* and *Access* of WPI. Instead, HPI tends to discriminate cases (countries) more relevantly than FI, although the specific contribution of HPI to the overall variance is much lower than that of FI.
In any case, it is worth noting that WPI has much lower statistical correlation with HPI than with HDI or GDP. Or, in the same direction, WPI is more strongly related to HDI and GDP than to HPI. A corollary is that HPI provides more complementary information to WPI than HDI or GDP. Appendix 3 presents details and further analyses of results.

4.3. Water Poverty Index and Population Distribution

Previous sections have focused on the analyses of WPI and its relationships with other indices using data at country level. All countries have been treated as equally relevant cases from a statistical point of view. However, population varies significantly among different countries, thus the capacity of discrimination of the different variables as regards to people will be distinct from that indicated previously. In this subsection, results from a first approach to the influence of countries' population are presented as a tracking indicator for WPI usefulness at the state level. Firstly, a comparison between HDI and WPI was made in terms of population distribution among index's values. Secondly, analysis was deepened to the WPI sub indices. Detailed analysis is presented in Appendix 4.
WPI concentrates population in a short range: 2,822 million people, i.e. 45% of world population, lay in 1/20 of the index scale. Country's concentration without considering their population shows more even distribution, yet 51% of the countries fit into 3/20 of the WPI scale, and three values are taking more than 15% of the total number of

countries each. In both cases, *Human Development Index* gets a better distribution of countries along the index scale, with a maximum of 28% of population in 1/20 of the scale, and only one case of 1/20 of the scale with more than 15% of countries.
A separate study of population and countries distribution against each WPI sub-indices was made in order to shed light as to why WPI minimizes the differences in the final result. The resolution of WPI drops dramatically by the *Environment* sub-index, whilst *Resources* and *Access* sub-indices show the highest resolution. This seems to reflect the fact that *Resources* and *Access* are apparently the WPI components which are easier to quantify by traditional indicators and variables. On the contrary, environmental conditions are more difficult to quantify by objective indicators in the WPI. Sullivan and Meigh (2007) state, from a comparative study of pilot sites at local scale, that further work needs to be done in order to identify variables to represent the *Environment* component, particularly in urban areas. This improvement is also needed at the national scale.

4.4.Application of Water Poverty Index at Different Spatial Scales

Several methodological applications of WPI at different scales have been published in recent years (Lawrence *et al.*, 2002; Sullivan *et al.*, 2003; Cullis and O'Reagan, 2004; Heidecke, 2006; Sullivan and Meigh, 2007). These include national, district, basin and community levels. The authors have analyzed in detail the particularities of the application of WPI methodologies at different scales, and the suitability of the index to make comprehensive assessment of the water sector in a given region has been demonstrated.
The above mentioned WPI methodology was applied to the case of Benin at regional scales (Heidecke, 2006). In that work, the performance of the WPI was analyzed in terms of the accuracy of the data integrated to the WPI. The calculation of the WPI would be influenced by the quality of the datasets, which may vary with their countries of origin. A straightforward conclusion which can be derived is that WPI results can only be as accurate as the data involved in the calculation (Heidecke, 2006). This is an event that a proper evaluation of the WPI should always contemplate. Most variables included in WPI calculation need to be collected from country official departments (either at local, regional or national scales) but many of that variables are defined

differently among countries. Then, countries with loose definitions with respect to, for instance, water access or sanitation might score better than others with a stricter regulation, which might not necessarily reflect the actual situation of those countries. This fact is a common drawback for all water indicators and has been also pointed out recently by Sullivan and Meigh (2007).

Some problems have been reported when applying WPI for monitoring purposes. For instance, at a national scale, current WPI cannot be used for tracking the water sector performance of a given country since the WPI definition used is related to the rest of the countries (Lawrence *et al.*, 2002). This national WPI methodology is able to produce a ranking of water poverty for all countries. However, the increase of WPI in a country during a given time period may not reflect a real improvement but could actually be due to the worsening of other countries.

The ability of tracking the time evolution of water poverty in particular areas, where a given action or program is (or has recently been) implemented is crucial for development practitioners. Cullis & O'Reagan (2004) applied the WPI methodology to study the water poverty status in South Africa. *Access* and *Capacity* sub-indices needed to be computed with the last census available which has not been updated since 1996, which entails that the impact of actions developed to improve both subcomponents since 1996 could not be reflected in the final WPI results.

From our point of view, the main challenges facing the application of the index at various scales are as follows:

Data collected to compute the sub-indices are not consistent between different spatial scales, meaning that spatial comparison is only possible between the same scale units (two countries, two regions, or two communities). The contribution of a given improvement in one scale may not be reflected in the upper level, thus it is not integrative as to be up-scaled in a bottom-up procedure. In fact, variables at the community scale can be quite qualitative whereas variables at national scale are based on quantitative assessment of international organizations and research centers, which makes it very difficult to establish the relationship between different scales.

The possibility to update national WPI data, as currently defined, is very time-distanced. The fact that some data sets are based on household surveys, or similar national level data collection routines make very difficult to asses the improvements made in a given country in a given period.

5. CONCLUSIONS: THE NEED OF EASSY INDICATORS

There is an urgent need for having adequate performance indicators to track improvement in water sector in developing countries. The volume of funds channeled through local public entities represents around 60% of total investment in the sector, and will increase in the next years with the majority of funds from international cooperation being channeled through the public sector.

The *Water Poverty Index* has proved to be highly reliable to describe the water situation, since, unlike other deterministic water-resource assessment models, it explicitly contemplates the importance of political, institutional and environmental issues. Recognizing this fact, some constraints have been described in this chapter about WPI as a practical tool to be widely used by development practitioners.

Comparison with other relevant country development indicators, as HDI and HPI, has helped to understand WPI itself and relationships between its sub-indices. Factorial analyses of data presented by Mukherji (2006) and some additional indicators have been presented. WPI has been confirmed to display a higher correlation with HDI and logarithm of GDP than with HPI or *Falkenmark Index*. Highest correlations have been found between HDI and *Access* and *Capacity* sub-indices of WPI. Also a high correlation between *Access* sub-index and WPI as a whole has been observed. A detailed look at the results has shown that contributions of *Environmental*, *Use* and *Resources* sub-indices of WPI are *equilibrated*, i.e. they describe variability in a similar amount and in complementary aspects of the data. Instead, *Capacity* and *Access* sub-indices both represent fundamentally the same variability; different from ones of three previously cited sub-indices, but equivalent to that of HDI and GDP. A reduced contribution of *Access* sub-index by itself, apart from that included in HDI and WPI *Capacity* sub-index, has also been identified, with a weight less than 20–25% of other sub-indices. Thus, as a general rule, HDI can be used to accurately approximate *Capacity* sub-index, at least at state level while its non-sector-focus nature is unsolved; and even more, *Access* sub-index can be also approximated by HDI, if a small reduction in WPI variability is admissible. On the other hand, a preferred relationship of *Falkenmark Index* with *Resources* sub-index has been confirmed. Extension of these analyses to sub-state WPI applications could confirm these trends and could open the discussion about the information contained in the variables definition.

Finally, with respect to WPI statistical analysis, world population histograms among WPI fractions at country level have been presented (see Appendix 4). It has been found that a narrow range of variation of the WPI *Environment* sub-index concentrates, not only number of countries, but also world population, situation more evident among Aid recipient countries. Thus, WPI methodology at state scale shows reduced sensitivity to discriminate country and population situations, especially in relation with environmental issues. The application of WPI at national level is based on internationally available data to rank countries, which make its use for monitoring national water policy performance not possible, since some variables are based on census repeated every 5 to 10 years in the best case scenario or in the information contained in world atlases. Moreover, ranking does not give direct information on the performance of a given country but its comparison with others performance.

The application of WPI at other scales (basin, region, community) has been proved to be valid and meaningful, but since the variables used at different levels are not exactly the same, the establishment of comparisons is not straightforward. This might happen as well within the same geographical level in a given country, when variables are not accurately defined (thus allowing different interpretation) or are taken from different years. Actual differences on the variables used at different scales makes impossible to define a nested bottom-up index that could be integrative. On the other hand, even the use of very simple practical indicators, such as those defined for tracking the *Millennium Development Goals*, need further improvement in definition and application to ensure appropriate implementation.

Given the importance of tracking water sector's performance on a yearly basis, it is crucial to include water sector-specific data collection routines, as it is implemented in other basic social sectors such as health. This entails that, in the short term, information has to be easily available at the local level at a reasonable cost, even if some measurement of some variables, such as resources or environment, have to be oversimplified. Including routine data collection at the lowest appropriate level would enable at the same time a better tracking of transparency and accountability at all levels, as well as national awareness on the importance of systematic data collection. Existing data provided by international institutions has the advantage of making a first cut comparison possible, but it suffers from the lack of reliable country owned information.

The adoption of EASSY (**E**asy to get at local level, **A**ccurately defined, **S**tandard and internationally applicable, **S**calable at all administrative levels, **Y**early updatable) variables for monitoring water sector performance will certainly require a proper definition from the scientific community, the involvement of donors and civil society, and government willingness to implement measures to collect them. It will be needed to complement other geographical, environmental and hydrological information systems in order to define an internationally agreed reliable and updatable *Water Sector Indicator* that can be useful to monitor national water sector's performance over time and space.

acknowledgements

The authors want to express their gratitude to *Ingeniería sin Fronteras* (Engineering without Borders), a partnership of *Spanish Non-Governmental Organizations* dedicated to cooperation for development, which seeks to put technology at service of human development, in order to build a fairer world society. Thanks are also given to the *Marcelino Botín Foundation* and particularly to Prof. Ramón Llamas for the invitation to take part of this Forum. Víctor Vázquez, Quique Peña and Juan Manuel Galíndez have contributed to this work by providing constructive comments and suggestions to the first draft of the manuscript.

APPENDIX 1. WATER POVERTY INDEX VERSUS HUMAN DEVELOPMENT INDEX

Appendix 1 illustrates the relationship between *Water Poverty Index* (WPI), and *Human Development Index* (HDI), from data included in the UNDP Report (2005) and Lawrence *et al.* (2002). A total of 146 countries are considered. Donors and aid recipient countries have been separately identified.

Figures 2.1 to 2.6 present HDI versus WPI relationships. As Figures 2.1 to 2.3 show, there is a well-defined linear relationship between HDI and WPI (R^2 = 0.66) which becomes more strongly correlated with WPI *Access* component (R^2 = 0.75), and WPI *Capacity* (R^2 = 0.89). On the other hand, Figures 2.4 to 2.6 show no correlation among HDI and the *Resources*, *Use* and *Environment* WPI components.

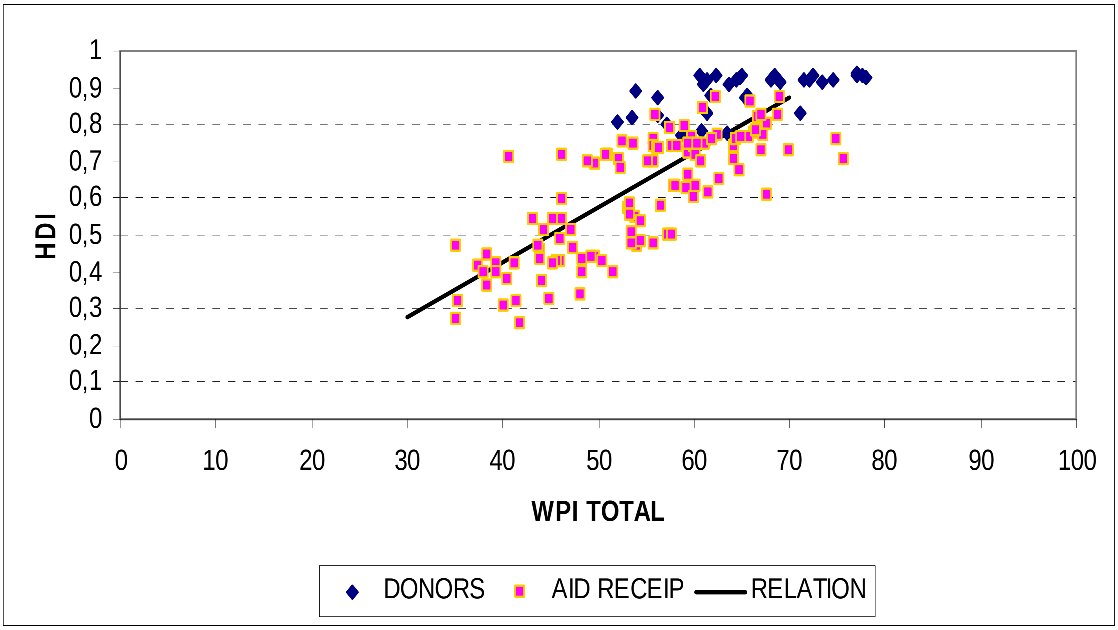

Figure 2.1. *Human Development Index* versus *Water Poverty Index*.

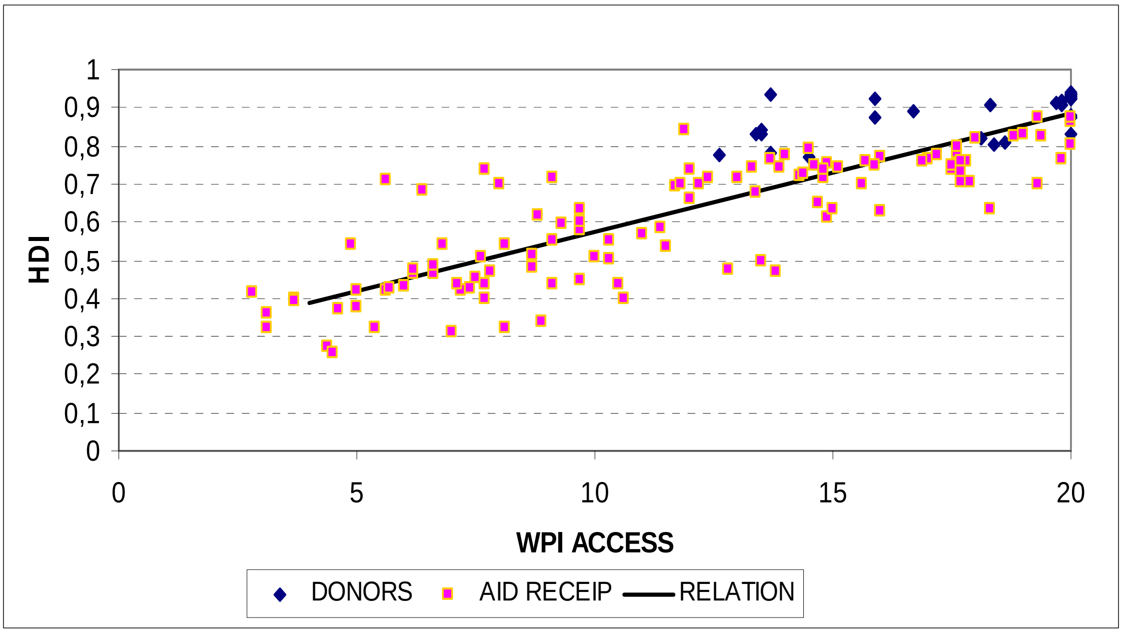

Figure 2.2 *Human Development Index* versus *Access* component of *Water Poverty Index*.

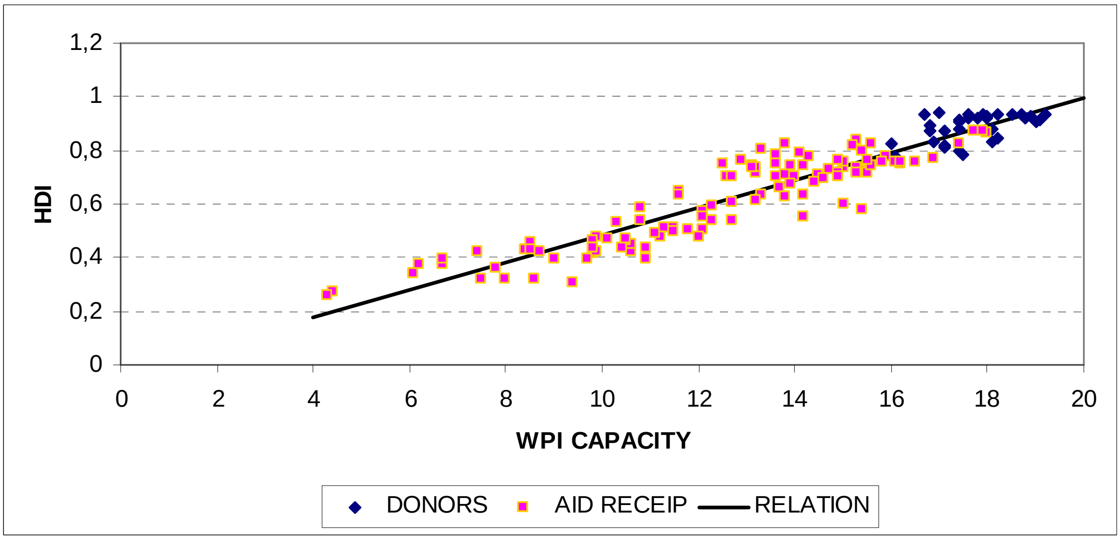

Figure 2.3. *Human Development Index* versus *Capacity* component of *Water Poverty Index*.

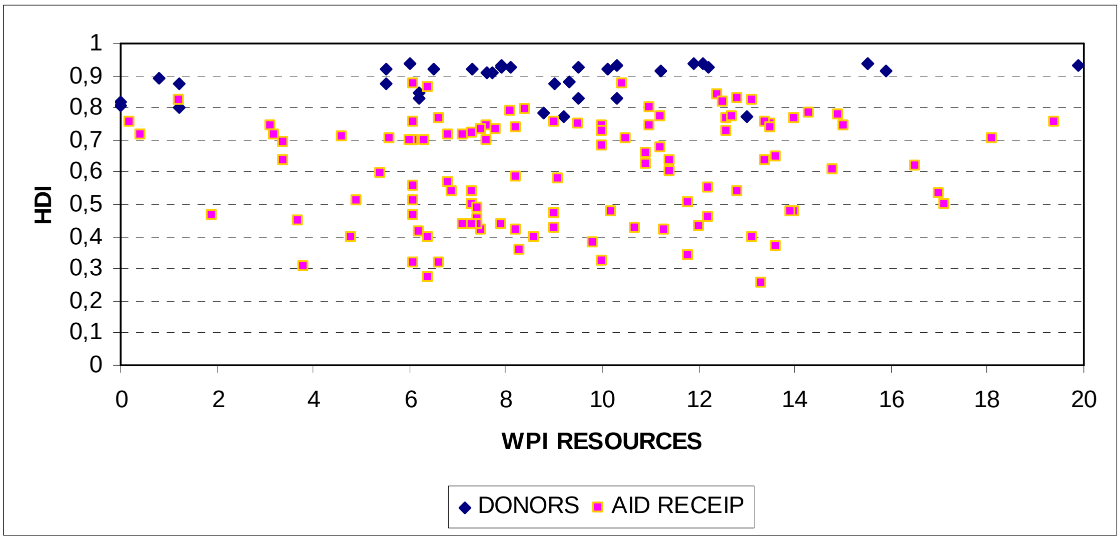

Figure 2.4. *Human Development Index* versus *Resources* component of *Water Poverty Index*.

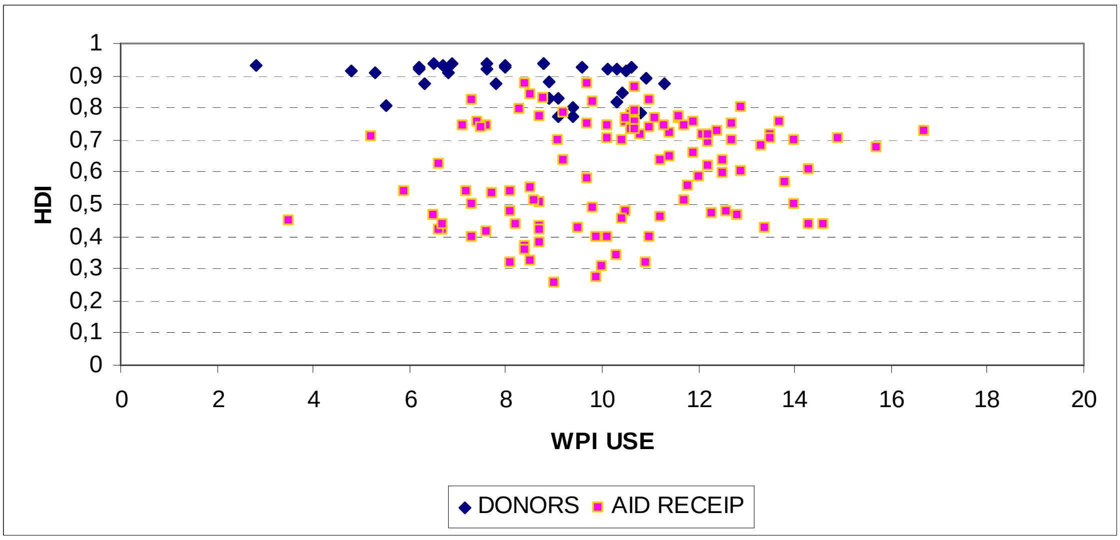

Figure 2.5. *Human Development Index* versus *Use* component of *Water Poverty Index*.

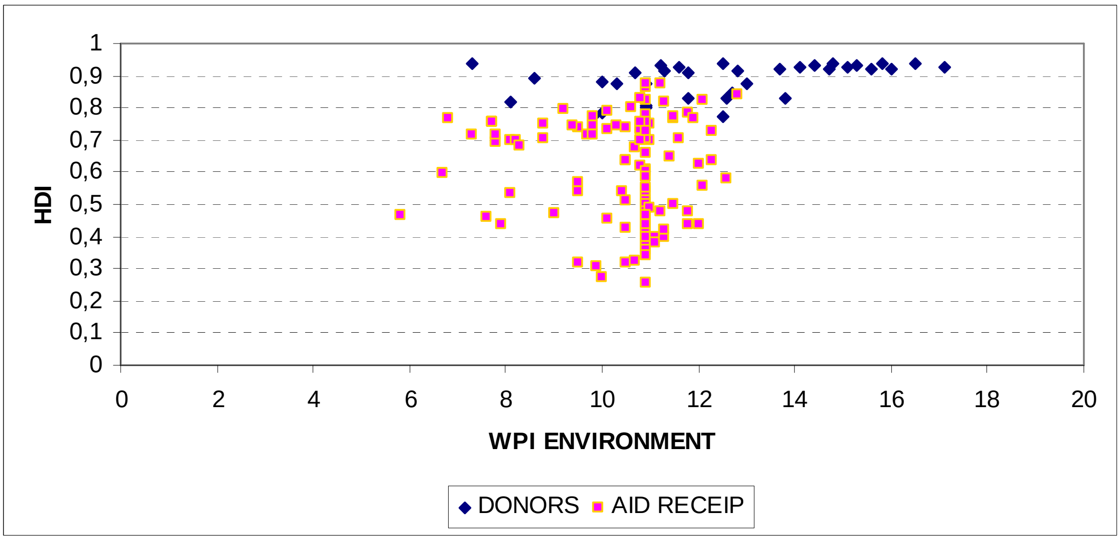

Figure 2.6. *Human Development Index* versus *Environment* component of *Water Poverty Index*.

APPENDIX 2. FACTORIAL ANALYSIS: WATER POVERTY INDEX AND HUMAN DEVELOPMENT INDEX

Appendix 2 provides a factorial analysis of HDI–WPI relationships using with the dataset previously used by Mukherji (2006). Table 2.2 presents the correlation matrix. Boldfaced numbers indicate correlation higher than 0.8 and underlined numbers correspond to relationships shown in Figures 2.2 to 2.7. Relationships between HDI and WPI, WPI–*Capacity* and WPI–*Access* are reflected here. The table shows the relatively high correlation between *Access* and *Capacity* subcomponents, and *Access* and overall WPI.

.

	WPI–RES	WPI–ACC	WPI–CAP	WPI–USE	WPI–ENV	WPI–TOT	HDI–2001	FI
WPI–RES	1.000							
WPI–ACC	0.057	1.000						
WPI–CAP	-0.056	**0.821**	1.000					
WPI–USE	-0.014	-0.053	-0.109	1.000				
WPI–ENV	0.275	0.275	0.282	-0.278	1.000			
WPI–TOT	0.457	**0.855**	0.767	0.123	0.468	1.000		
HDI–2001	0.031	**0.868**	**0.941**	-0.117	0.318	**0.809**	1.000	
FI	0.585	0.144	0.108	-0.037	0.056	0.345	0.108	1.000

Table 2.2. Correlation matrix. Data from Mukherji (2006)

Table 2.3 presents the factors (linear combination of initial variables) that explain the variability of the dataset. It is worth noting that the first three factors account for about 83% of the variability, a proportion that rises up to more than 99% when six factors are considered. The most redundant factor is the last one, with a nil contribution to the total variance. It corresponds, as expected, to the linear relationship between WPI and its five components. Next one, number seven, can also be deemed irrelevant. Furthermore, two more, numbers six and five, represent less than the 5% of the total variance each, because of which the relevance of their contributions can be also neglected.

Factor	% of total variance	% accumulated
1	47.578	47.578
2	20.616	68.194
3	14.794	**82.989**
4	9.700	**92.689**
5	4.340	**97.029**
6	2.331	**99.360**
7	0.640	100.000
8	0.000	100.000

Table 2.3 Variance explained by the factors.

Table 2.4 summarizes the communality of the set of factors considered (the variability of each variable explained by these factors). Results considering 3 to 6 factors are presented. Values lower than 0.9 are in boldface. Note that the variability of all initial variables can be explained by six factors (at least in 97% of cases), with five factors in a 90% and with four factors in an 87%. Considering only three factors, that threshold drops down to 60%. Therefore, the approximation of the eight variables with only the first four factors can be considered statistically acceptable (a global variance of 92%, and at least 87% of each variable contribution). Factors appearing in fifth and sixth positions complete the description of the variability of the dataset, with a 99% of global variance and a 97%, at least, of variance of each variable.

.

Communality	3 Factors	4 Factors	5 Factors	6 Factors
WPI–RES	0.859	**0.870**	0.992	1.000
WPI–ACC	0.883	0.890	**0.896**	1.000
WPI–CAP	0.907	0.928	0.932	0.982
WPI–USE	0.802	0.981	0.999	1.000
WPI–ENV	**0.601**	0.937	1.000	1.000
WPI–TOT	0.962	0.989	0.996	0.998
HDI–2001	0.937	0.947	0.948	0.969
FI	**0.687**	**0.874**	0.999	1.000

Table 2.4. Variation of each indicator explained by the 3, 4, 5, 6-factorial analysis

Before analyzing the relationship between factors and the initial variables, a rotated set of factors is computed for each case (sets of 3 to 6 factors). They are computed using *Varimax* criteria, responding the aim of a simple identification of the factors in terms of the variables. Table 2.5 summarizes the percentage of the total variance explained by the set of rotated factors. Main factor retains the 43–45% of total variance, regardless of the number of factors considered. The second to fifth factors have a similar weight, amounting between 13 and 15% of total variance each. The sixth factor only represents 2.5%.

% of Total Variance	3 Factors	4 Factors	5 Factors	6 Factors
Total	82.989	92.689	97.029	99.360
1	44.450	43.505	43.519	43.212
2	22.498	21.350	14.329	14.221
3	16.041	14.471	13.131	13.203
4		13.363	13.126	13.113
5			12.924	12.944
6				2.667

Table 2.5. Contribution of each rotated factor to total variation. Cases obtained from 3, 4, 5, 6-factors.

Table 2.6 includes the definition of each set of rotated factors in terms of the initial variables. Only values higher than 0.1 are listed. Boldfaced numbers are used for coefficients higher than 0.8 and other punctual representative values. Results allow for a clear interpretation of all factors found. The first factor includes *Capacity* and *Access* components of WPI, WPI itself and HDI. The second factor is directly related to *Resources* component of WPI, although it also includes the *Falkenmark Index* if less than five factors are extracted (the *Falkenmark Index* constitutes the core part of the fifth factor). The third and fourth factors are specifically related to *Environmental* and *Use* components of WPI and, finally, the sixth factor (the one with the lowest relevance) is related to Access component of WPI. It is reminded that the *Access* component is already part of the first factor, where it contributes more significantly than in the sixth one. Note that the first factor includes *Capacity* and *Access* components of WPI, HDI, and WPI, but later one has null contribution, so three main variables amount for a 43–45% of the total variance.

	1	2	3	4	5	6
HDI–2001	**0.958**		.136			
WPI–CAP	**0.944**		.113			
WPI–ACC	**0.937**					
WPI–TOT	**.874**	0.445				
WPI–RES		**0.920**	0.112			
FI		**0.824**				
WPI–USE			**-0.890**			
WPI–ENV	0.308	0.248	**0.667**			
HDI–2001	**0.964**		0.107			
WPI–CAP	**0.957**					
WPI–ACC	**0.937**					
WPI–TOT	**0.831**	0.371	0.340	0.215		
FI	0.131	**0.908**	-0.157			
WPI–RES		**0.858**	0.352			
WPI–ENV	0.221		**0.923**	-0.175		
WPI–USE			-0.144	**0.980**		
HDI–2001	**0.964**		0.107			
WPI–CAP	**0.947**	-0.130				
WPI–ACC	**0.942**					
WPI–TOT	**0.843**	0.387	0.273	0.187	0.158	
WPI–RES		**0.930**	0.150		0.325	
WPI–ENV	0.213	0.143	**0.955**	-0.150		
WPI–USE			-0.131	**0.990**		
FI		0.301			**0.948**	
HDI–2001	**0.973**		0.106			
WPI–CAP	**0.963**	-0.101				-0.174
WPI–ACC	**0.914**					**0.394**
WPI–TOT	**0.834**	0.377	0.279	0.185	0.165	0.148
WPI–RES		**0.935**	0.149		0.321	
WPI–ENV	0.210	0.142	**0.956**	-0.150		
WPI–USE			-0.131	**0.991**		
FI		0.300			**0.949**	

Table 2.6. Normalized coefficients of the factors expressed in terms of the initial variables. Cases obtained from 3, 4, 5, 6-factors analysis are included

APPENDIX 3. FACTORIAL ANALYSIS: WATER POVERTY INDEX AND HUMAN POVERTY INDEX

Appendix 3 focuses on the relationship between WPI and the *Human Poverty Index* (HPI) through factorial analysis, following same steps of Appendix 2. Also the decimal logarithm of the *Gross Domestic Product* (GDP) per capita, expressed in PPP terms at current international dollars, is included in the analysis, referred to as LG10_GDP. Data of both indicators refer to year 2004. Also updated HDI data from 2004 are used. All new data were obtained from *EarthTrends* data service (see http://earthtrends.wri.org). Analyses including HPI have been done involving 120 countries, and with also LG10_GDP with just 107 countries. Table 6 presents the main rotated factors of the system obtained with a seven-factor analysis. Partial contributions to total variance are included, as well as the total value represented by the seven factors, i.e. 98.799%.

First conclusion of analyses is that the inclusion of logarithm of GDP and HPI modifies neither the statistical behaviour nor the conclusions of the analysis of just WPI and HDI presented in Appendix 2. A strong relationship between HDI, Logarithm of GDP, and *Capacity* and *Access* components of WPI has also been found. Moreover, the second to fifth factors are related respectively with FI and *Environment*, *Resources* and *Use* components of WPI, with around 9–12% of contribution to total variance each. And finally, the *Access* component appears, apart from its contribution on the first factor, leading the seventh factor, with less than 2.5% of contribution to total variance, and less than a quarter of that from fifth and higher factors, which represents the *Environment*, *Resources* and *Use* components of WPI (compare 2.267 with 9.568 and so on in Table 6). Thus, its specific contribution can be easily neglected.

Main difference with Appendix 2 is found when analysing HPI, which have a negative influence on the first factor and it appears leading the sixth factor. Sixth factor contribution represents 4% of total variance, about 40% of any from higher factors (compare 3.912 with 9.568 and so on in Table 2.7), so its contribution can be considered not negligible.

% of Total Variance	1	2	3	4	5	6	7
98.799	49.829	11.798	10.809	10.615	9.568	3.912	2.267
HDI–2004	**0.967**					-0.173	
WPI–CAP	**0.964**						-0.111
LG10–GDP	**0.946**		0.183	-0.135			
WPI–ACC	**0.901**						**0.418**
WPI–TOT	**0.847**	0.174	0.280	0.170	0.323		0.186
HPI–2004	**-0.797**					**0.597**	
FI		**0.953**			0.299		
WPI–ENV	0.236		**0.950**	-0.167	0.115		
WPI–USE			-0.144	**0.987**			
WPI–RES		0.486	0.144		**0.861**		

Table 2.7. Coefficients of the rotated factors, obtained with a seven-factors analysis. Contribution of each one to total variation is also included.

HPI appears leading a specific factor when five-factor (or greater) analyses are computed. This factor appears first, with fewer factors, than that representing FI. Thus, HPI tends to discriminate cases (countries) more relevantly than FI. However, the specific contribution of HPI to the overall variance is much lower than that of FI (note that part of HPI contribution is also represented by HDI and others in factor 1).

Apart from the role of HPI and GDP, note that new HDI data, from 2004, present higher correlations with WPI's *Capacity* and *Access* components than those obtained in Appendix 2 with data from 2001. It can be caused by the number of countries considered, which has been reduced in these analyses. In any case, this fact confirms that HDI can approximate robustly both components of WPI, especially the *Capacity* one, at least when considering states.

APPENDIX 4. WATER POVERTY INDEX AND POPULATION DISTRIBUTION

Appendix 4 analyzes the ability of the WPI to represent differences among countries. Firstly, a comparison between HDI and WPI is made in terms of population distribution among index's values. Secondly, analysis is deepened to the WPI sub indices.

Figure 2.7 shows the world population distribution (UNDP, 2005) among the index fraction for both HDI and WPI (data from Lawrence *et al.*, 2002). It can be seen that WPI concentrates population in a short range: 2,822 million people, i.e. 45% of world population, lay in 1/20 of the index scale. Analyzing the number of countries in each fraction of both indices, it is noticeable that countries concentration without considering their population shows a more even distribution, yet 51% of the countries fit into 3/20 of the WPI scale, and three values are taking more than 15% of the total number of countries each. In both cases, HDI gets a better distribution of countries along the index scale, with a maximum of 28% of population in 1/20 of the scale, and only one case of 1/20 of the scale with more than 15% of countries.

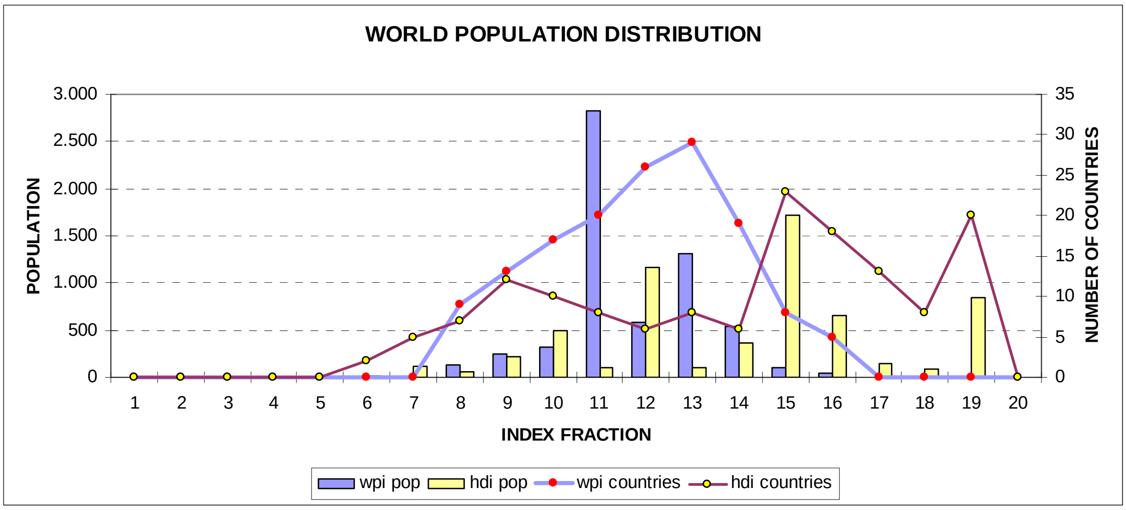

Figure 2.7. Population distribution and number of countries distributions among fractions of the *Human Development Index* and the *Water Poverty Index*.

To deepen in this analysis, population distribution of water sector's aid recipient countries (excluding China and India) against WPI values has been made. As can be seen in Figure 2.8, WPI lacks the ability to discriminate the countries situation among developing countries. Considering 2,653 million people as the rest of aid recipient countries population (after excluding China and India), 29.63% of them lay in 1/20 of the scale, and 3 consecutive fractions include 65% of the population. Only 8 out of 20 fractions of the index scale include some country or the other. In terms of number of countries, the WPI performs better, but we still find almost 29% of countries represented in 10% of the scale, and almost 50% of them among four consecutive fractions.

A separate study of population and countries distribution against each WPI sub-indices is presented, in order to shed light as to why WPI minimizes the differences in the final result. Figures 2.9 to 2.13 show the population distribution over the range of possible values in the 5 independent components of the WPI. Figure 2.9 shows that *Access* sub-index classifies the world population along almost every possible value. None of unity ranges of the sub-index includes more than 10 countries. The *Resources* sub-index seems to have resolution enough to show differences between the countries. Computed values range from 0 to 18, and world population distributes over all possible situations (Figure 2.10). *Capacity* and *Use* sub-indices distribute world population less than *Resources* and *Access*, lacking resolution to represent the actual differences among different countries. It can be seen in Figures 2.11 and 2.12 that in neither case sub-indices vary over their full range. *Capacity* component starts at 4 and ends at 19 (i.e. 75% of the full range) and *Use* component starts at 3 and ends at 17. The *Environment* sub-index is actually the component responsible of minimizing the differences in WPI values between people. Figure 2.13 shows how 2 consecutive fractions of the *Environment* sub-index (of a total of 20 fractions) are covering 66.41% of the population and 54.81% of countries. All countries lay between WPI-*Environment* values of 5 and 13, and one single fraction includes 55 countries.

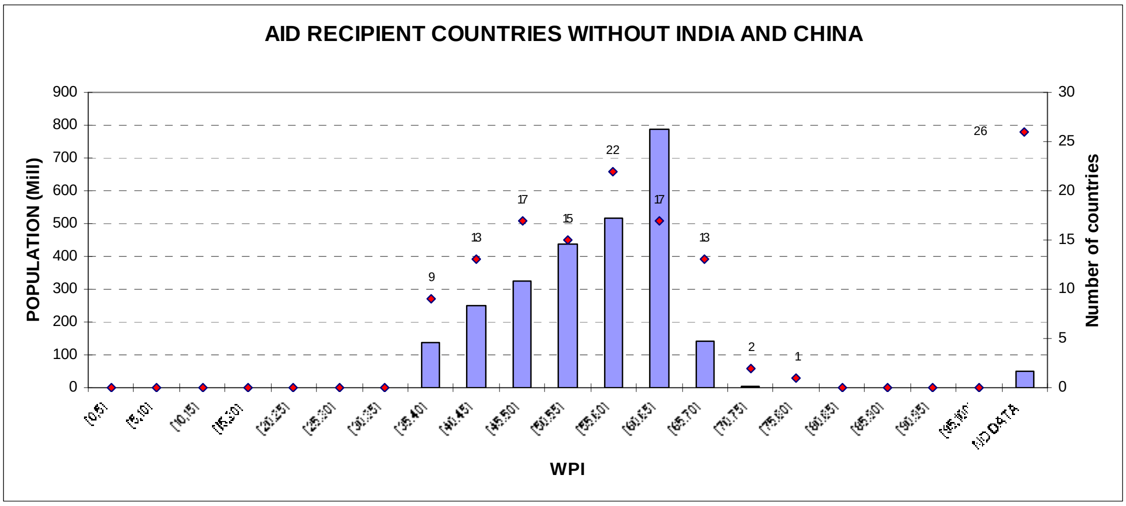

Figure 2.8. Population and number of countries distribution among fractions of the *Water Poverty Index* (aid recipient countries without China and India). Population is given in millions units.

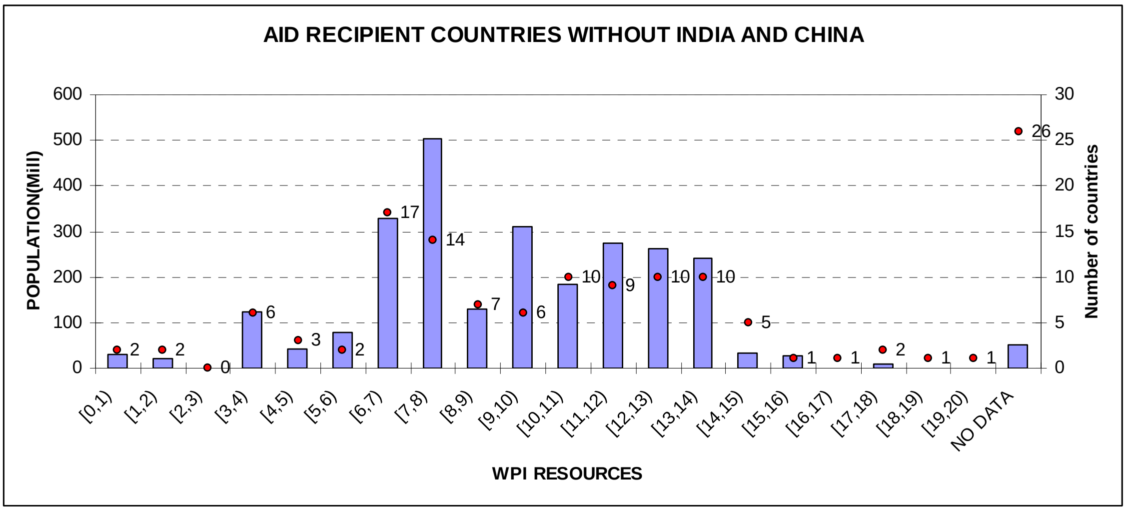

Figure 2.9. Population and number of countries distribution among fractions of the WPI-*Access* component (aid recipient countries without China and India). Population is given in millions units.

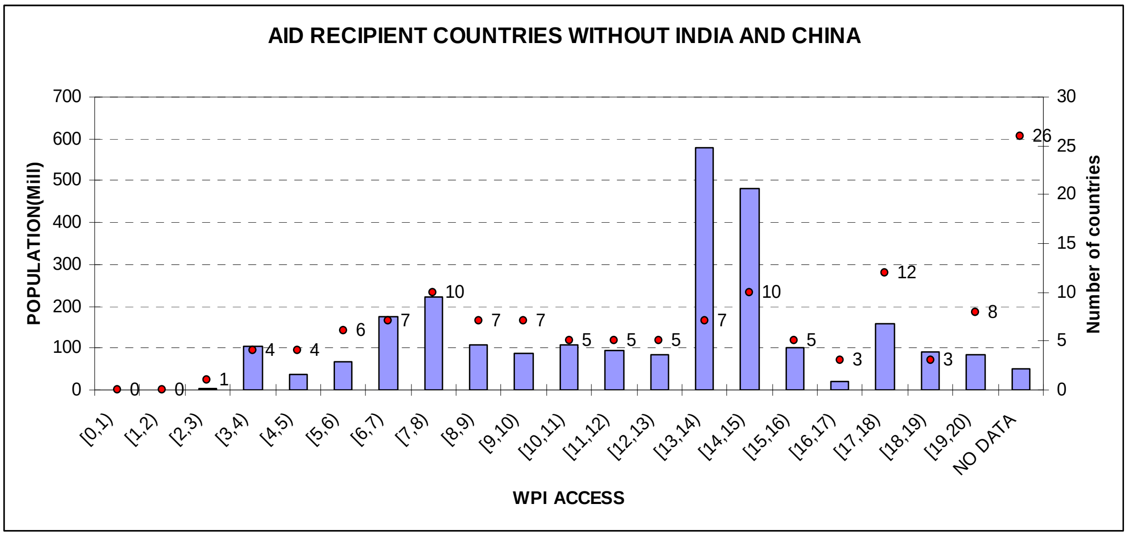

Figure 2.10. Population and number of countries distribution among fractions of the WPI-*Resources* component (aid recipient countries without China and India). Population is given in millions units.

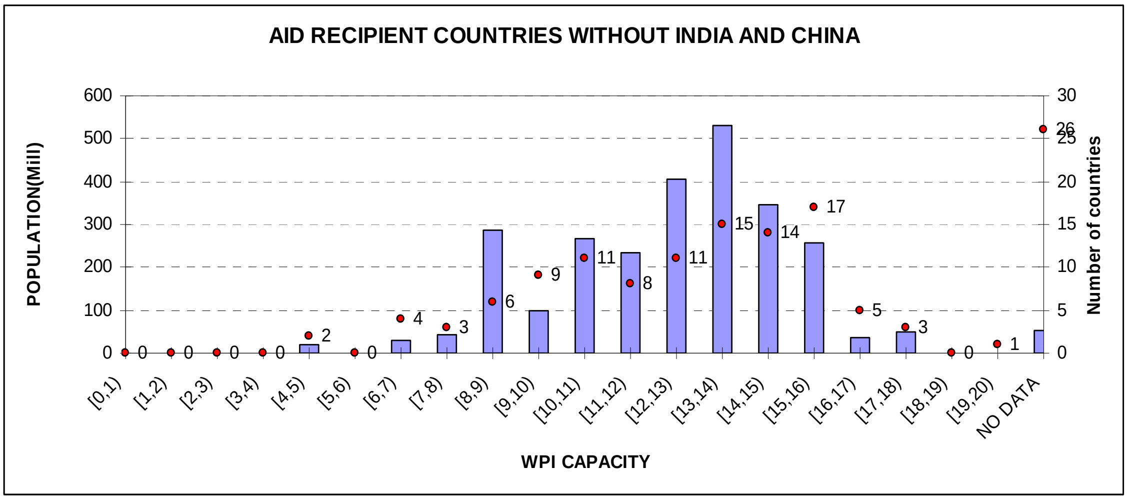

Figure 2.11. Population and number of countries distribution among fractions of the WPI-*Capacity* component (aid recipient countries without China and India). Population is given in millions units.

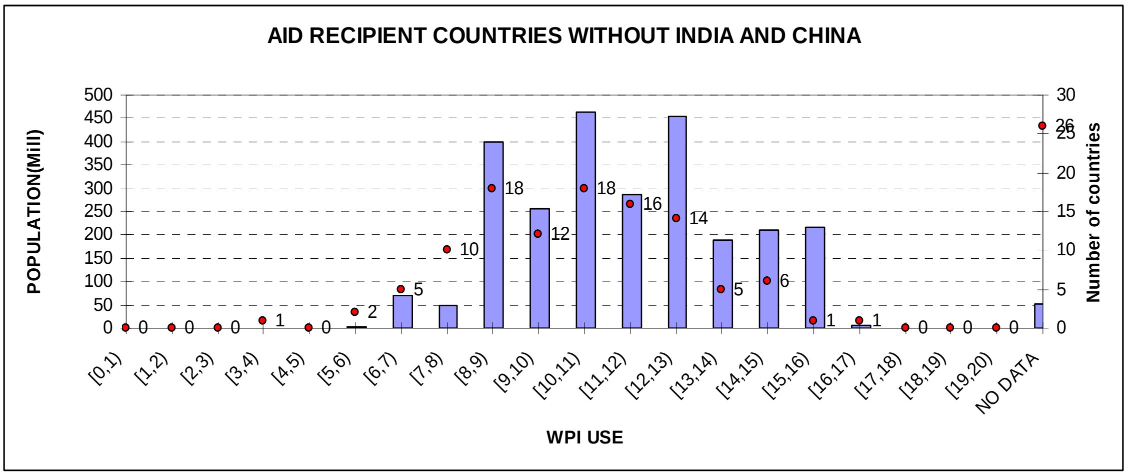

Figure 2.12. Population and number of countries distribution among fractions of the WPI-*Use* component (aid recipient countries without China and India). Population is given in millions units.

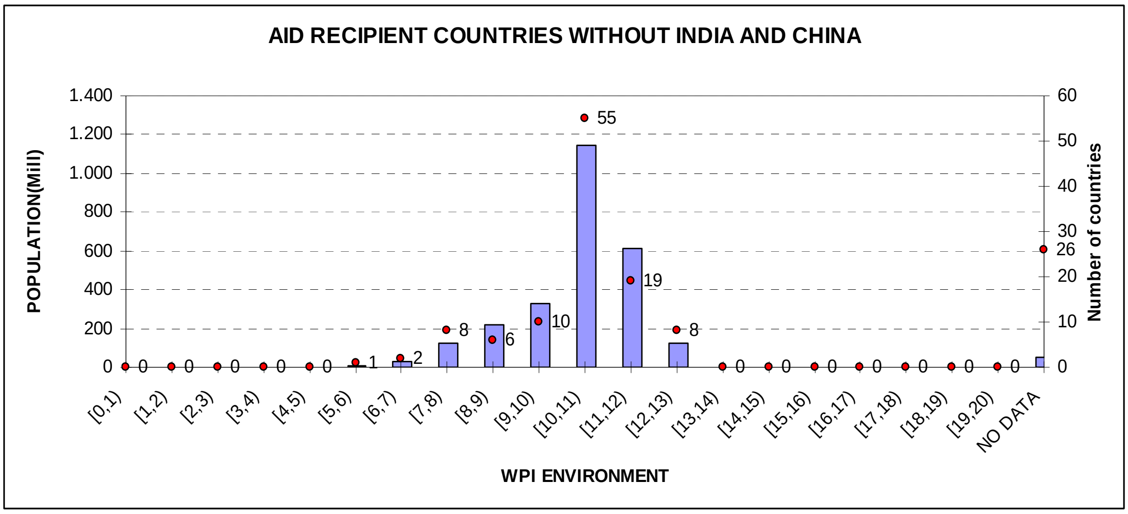

Figure 2.13. Population and number of countries distribution among fractions of the WPI-*Environment* component (aid recipient countries without China and India). Population is given in millions units.

CHAPTER 3

Improving water access indicators in developing countries: a proposal using water point mapping methodology.

ABSTRACT

The current international definition of indicators of access is insufficient for monitoring the water sector at national level, as it has been detailed in chapter 2. Furthermore, the lack of an internationally agreed definition and measurement methodology is causing confusion and uncertainty regarding the figures that are disseminated worldwide. Moreover, the current context, in which almost 70% of funds for the sector are channelled through national governments, emphasises the importance of a monitoring system for national water sectors in developing countries. From this, an improvement in investment efficiency is expected. The water point mapping methodology is presented as an alternative way of defining water access indicators. The present chapter describes its potential for defining new indicators and making improvements.

This chapter is based on

Jiménez, A., Pérez Foguet, A.,(2008). Improving water access indicators in developing countries: a proposal using water point mapping methodology. *Water Science & Technology: Water Supply—WSTWS*, 8 (3): 279–287.

1. INTRODUCTION

The most important monitoring task in the water sector is carried out at the international level by the WHO and the UNICEF Joint Monitoring Programme for Water Supply and Sanitation (JMP), whose main goal is to track the fulfilment of the Millennium Development Goals. The most used and suitable indicator for Target 10 is the number of people with "access to improved" water sources (WHO/UNICEF, 2000, 2005). "Access" is usually evaluated by household surveys and includes personal interpretation about what it means and is therefore not as objective as policy provisions claim. "Improved" water sources is better defined (table 2.1.)However, the coverage figures from technological indicators do not provide enough information about the quality of the water provided or about its use (WHO/UNICEF, 2000). Moreover, no information is collected regarding the sustainability of the service.

There are several ways in which "Access" can be interpreted. In rural Tanzania, for example, it is stated that "the basic level of service for domestic water supply in rural areas shall be a protected, year-round supply of 25 litres of potable water per capita per day, through water points located within 400 meters from the furthest homestead and serving 250 persons per outlet" (GoT, 2002). However, in Mozambique this water point would serve 500 people in a radius of no more than 500 m (GoM, 1995). This highlights how the indicators must not only be accurately defined but also standardized and internationally applied. The use of equivalent indicators across different nations would lessen confusion by facilitating comparisons of performance, uniform sector information collection systems, and the avoidance of misinterpretations of definitions.

This chapter addresses the issue of monitoring water poverty in developing countries, a process that must involve establishing EASSY indicators: Easy to get at the local level, Accurately defined, Standardized and internationally applied, Scalable at all administrative levels, Yearly updatable (Jiménez et al., 2009). Water service is provided at different water points distributed across the territory and by many different actors. This then requires that indicators be integrative from the lowest level so as to include all the activity that takes place in a certain area and allow for local and regional trends. Water point mapping is proposed as an option for establishing water access indicators, and new improvements, which include issues of quality and sustainability, are defined within it. Challenges to its effective implementation are discussed in the conclusions.

2. METHODOLOGY: WATER POINT MAPPING

For over a decade, a variety of water points mapping activities have been carried out, the scope and objectives of which have been diverse (WaterAid, ODI, 2005). In the majority of cases, these activities have addressed the lack of accurate, reliable local data that international programmes and local governments require to plan investments. This is enormously important since many countries are currently going through a process of decentralization that will transfer the responsibility of resource allocation to local planners. Furthermore, the problem of inefficiency in international programmes often stems from the lack of coordination with other initiatives in a particular zone (Birdsall, 2004). Moreover, the MDGs tend to target those without access. Success will not come simply by achieving a certain level of balanced investment in a region, but by targeting those areas where service is below minimum requirements. As demonstrated by Stoupy et al. (2003), given enough investment, untargeted allocations due to unreliable information at the local level can make the difference between achieving the MDGs or not.

Water point mapping (WPM) can be defined as an "exercise whereby the geographical positions of all improved water points in an area are gathered in addition to management, technical and demographical information. This information is collected using GPS and a questionnaire located at each water point. The data is entered into a geographical information system and then correlated with available demographic, administrative, and physical data. The information is displayed using digital maps." (WaterAid, ODI, 2005). WPM's main function is to simply and objectively demonstrate how water points are distributed within a territory; thus it serves as a valuable analysis and planning tool for decentralized governments that improves efficiency and accountability. Moreover, it helps to define reliable indicators of access constructed from the lowest geographical level with the data available. By using an example, the following section explores the results of WPM and the challenges it faces in compiling effective indicators of sustainable access to safe drinking water. Evidence is taken from field work carried out in the rural Same district, Tanzania, during the second semester of

2006. In this case study, the Standard Water Point Mapping campaign, as it has been defined, was completed with quality assessments. Portable water kits were used to test all the functional water systems in the rural Same district and networks were examined at either one or two points, depending on their size. All the individual functional water points were analysed. The parameters that were measured include pH, turbidity, chlorine, electrical conductivity and concentration of thermotolerant (faecal) coliforms. A total of 723 water points were mapped and 138 water quality tests were undertaken. The field work lasted 29 days, covering an area of 5,186 km2 where 185,169 people live in rural communities.

3. RESULTS

Target 10 of the Millennium Development Goals advocates an increase in "sustainable access to safe drinking water and basic sanitation" and covers the three aspects listed below.

- Access: Access can be divided into "physical access", defined in national policies that establish maximum values for the distance to a water point and the number of people served by a water point (see examples above) and "socio-political access", which includes aspects that influence access, such as the affordability of the service. Furthermore, it calls for no discrimination on the grounds of sex, age, ethnicity, etc.
- Quality (safe): Potable water is defined by quality standards, which vary between nations. Nevertheless, the more recent concept of safe water is not being measured directly using indicators, but indirectly, assuming that improved sources provide safe water.
- Guarantee of service (sustainable): Sustainability is a broad and complex concept. Related to a water system, it stresses the permanence in time of that service. There are many factors that affect sustainability and the majority are interdependent and can be environmental and/or social. They may be complicated by a political or economic context and require institutional arrangements for the effective management of the service (Harvey et al., 2004).

3.1. Defining Access

An Improved Community Water Point (ICWP), as defined in the WaterAid methodology (Stoupy et al., 2003), is a place with some improved facilities where water is drawn for various uses such as drinking, washing and cooking. The types of water points considered as improved are consistent with those accepted internationally and were presented in Table 2.1. As previously explained, access is normally defined by establishing a ratio of the maximum distance and number of people served by each water point. In the case of Tanzania, this ratio would be one water point for 250 people within a radius of 400 m. At this stage there are three possibilities for defining this measurement:

- The number of people served per water point, considering that one water point serves 250 people, regardless of whether their households are further than 400 m from the water point.
- The number of people served, including families living less than 400 m from the water point, regardless of whether the number of people is more than 250.
- A case-specific approach combining both of the above conditions and applying the most restrictive one in each scenario.

In order to accurately assess the number of people served using distance as a criterion, the population distribution at the household level is required, which might be problematic in the near future for the majority of countries involved. However, due to the concept of the periodic sociological census, population distribution in administrative structures is usually quite well documented. Thus, the first measuring option mentioned may be the most appropriate. Of course, this reduces the accuracy of the methodology since inequity is only considered up to the administrative level, at which the population information is aggregated. Moreover, the availability of defined administrative boundaries could hinder the level of detail of our analysis: in the case of the Same district in Tanzania, information on population distribution is available at the village and hamlet level, but administrative boundaries are only defined at the ward level and thus determine the spatial resolution of the analysis. With this information, the percentage of access in an area can be accurately estimated. The first indicator of access defined is Improved Community Water Point Density (ICWPD), which is equal to the number of ICWP per 1000 inhabitants. If we continue with the example of Tanzania, a certain area would have access if its density were four or more water points per inhabitant. The percentage of people not served in an area would be proportional to the lack of water points available compared to that threshold. However, it is simple to further improve ICWP because information on functionality for each water point is also collected during the survey. The difference between in-place water points and functional ones would normally amount to more than 30% and is thus an important factor for consideration. Consequently, Functional Community Water Point Density (FCWPD) is used by WaterAid as the real access indicator.

Figure 3.1 shows the FCWPD for the Same district at the end of 2006. Information is displayed by ward, with between 10,000 and 20,000 people in each. The legend represents ward access status based on a colour code: red represents the most underserved wards (less than 1 FCWP/1000 people), while dark green represents wards with more than four FCWP/1000 people (above the official threshold for access).

Figure 3.2. shows different variables (seasnolaity and quality of water delivered) represented by village, and including different sizes of population. This demonstrates the potential for this methodology to identify underserved areas and improve planning.

An important point to highlight is that the percentage of the population with access to water in the Same district, assessed using this methodology, is 42.74%. This is lower than the percentage found based on household surveys in the same area (51.64%) (Tanzania Ministry of Water, based on Household Budget Census 2002).

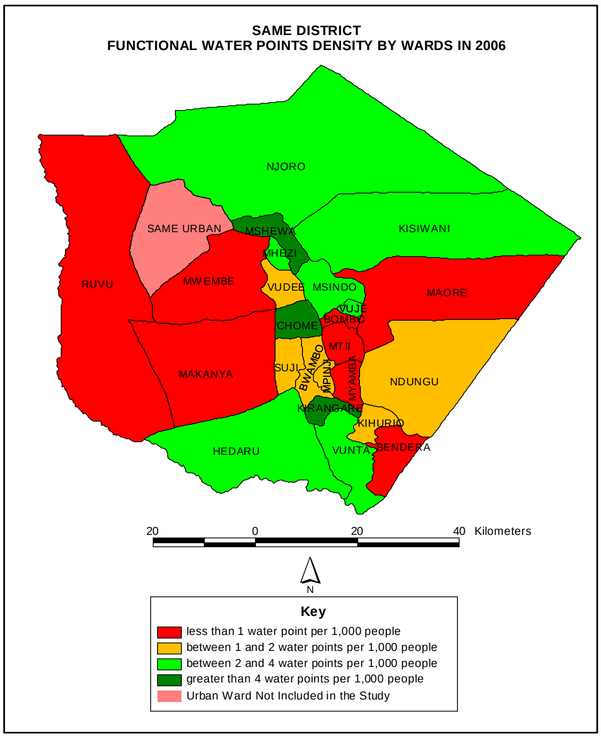

Figure 3.1. Functional Water Point Density by Ward in Same District. Produced by Geodata S.L. under private contract with ISF-Tanzania.

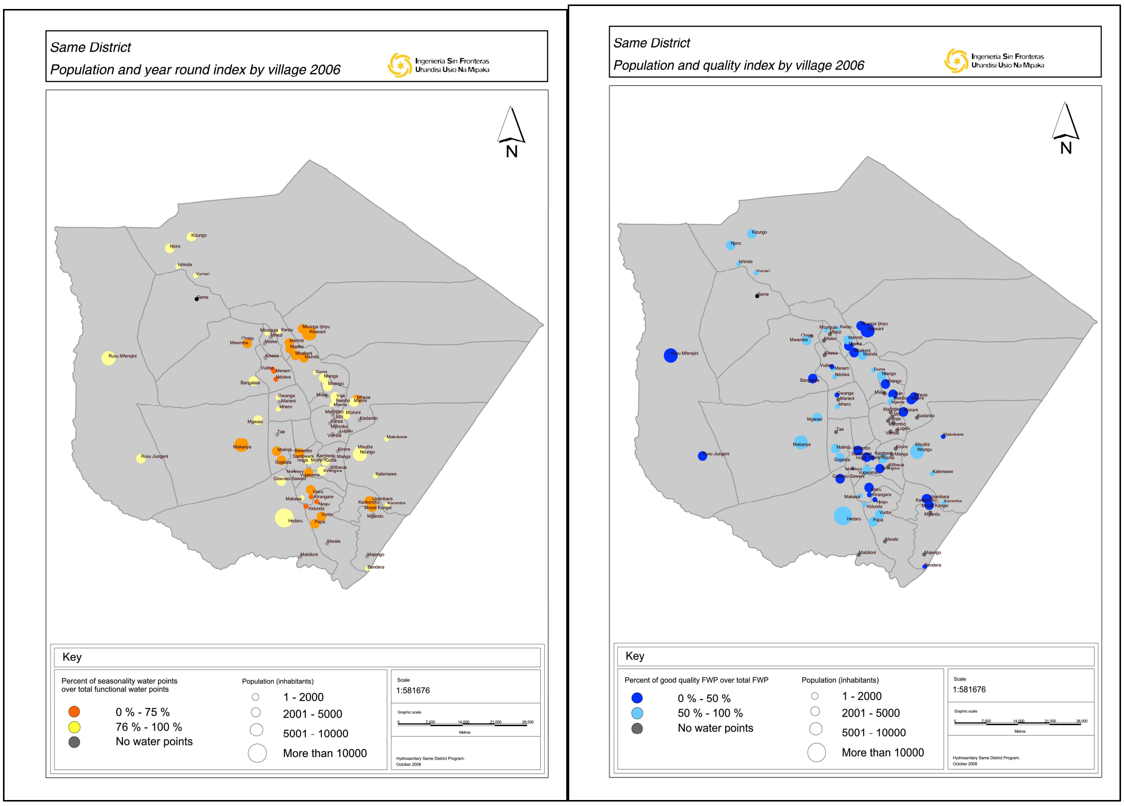

Figure 3.2. Seasonality and Good Quality Water Points per village in Same District. Produced by ISF.

3.2. Defining Safe

The previous section demonstrated that water point mapping provides much more reliable information for defining the concept of access to water than does data extrapolated from surveys. Based on this methodology and figures from the UN Taskforce, it is assumed that safe water is provided indirectly by an improvement in technology. ISF experience in the Same district gives some evidence for the extent to which we can believe that improved water points do provide safe water. The concentration of coliforms, because of its importance in public health, was included in the data collected in order to accurately define the indicator. Out of the 138 water quality analyses some type of faecal coliform was found in 42% of them, including 31% of the tanks examined. Based on Tanzanian standards for water quality, which establish a threshold for potable water of 10 coliform/100 ml, 306 out of 403 functioning water points provided an acceptable quality of water. Our analysis found that a total of 40% of hand pumps, 26% of gravity water points and 22% of protected springs were delivering contaminated water. A total of 20 villages out of 67 had quality problems in their systems. The definitions of Bacteriological Acceptable Water Point Density, defined as the amount of FCWP providing water with an acceptable concentration of faecal coliform at the time of the test (Tanzanian standards), have reduced water coverage from 42.74% (when only functionality is considered) to 31.37%.

3.3. Defining Sustainable

The fact of the guarantee of service provided has up to now been overlooked in the indicators. Factors affecting this aspect are numerous and interdependent. WPM provides valuable information collected from questionnaires that include information on seasonality, frequency and reactivity to breakdowns, the financial status of the system and institutional arrangements in place for management (Jiménez et al., 2007). Nevertheless, despite the information available it remains difficult to measure sustainability in an objective and standardized fashion. It is important that institutional arrangements and financial system status undergo a detailed analysis for each individual case. Reactivity to breakdowns could be used as a proxy to assess the concept, but more research is needed on how to measure and standardize this aspect before indicators can be proposed.

In this first approach, ISF has analysed the seasonality of water points, reported by water users, as a precondition for sustainability. One water point is not considered functional all year round if water users report a seasonality of more than one month. With this concept we can define the Year-round Functional Water Point Density, which in the Same district was 30.78%, compared to 42.74% when only functionality was considered. This approximates the vulnerability of water services to dry or high demand seasons, though additional information must be considered when one is dealing with pastoralist and nomad populations, or when there is competition for water use in the area.

3.4. Defining Sustainable Access to Safe Drinking Water

If we consider a single indicator that includes information on both quality and seasonality, we can define the Bacteriological Acceptable and Year-round Functional Water Point Density. This indicator reduces water access figures in the Same district to 25.29%. Table 3.1 summarizes the indicators provided by central governments, WaterAid WPM and the ISF proposal. The bold style represents the access indicator used by each methodology and the third column shows the results obtained in terms of access for the case of the Same district. In this case, the difference in coverage obtained is significant. Basic quality and seasonality reduces access from 42.74% to 25.29% and thus reduces adequate coverage by 40.8%. Although it can be argued that the difference between surveys and mapping (from 51.64% to 42.74%) is due to statistical error during sampling, the introduction of quality and seasonality in the access indicator gives a reduction of 40%.

METHODOLOGY	INDICATORS PROVIDED	% ACCESS
Governmental Household Surveys	Aggregated Access Indicator	51.64%
WaterAid-Water Point Mapping	Improved Community Water Points Density	75.02%
	Functional Improved Community Water Points Density	42.74%
ISF-Water Point Mapping	Bacteriological Acceptable Functional ICWP Density	31.37%
	Year-round Functional ICWP Density	30.78%
	Bacteriological Acceptable and Year-round functional ICWP Density	25.29%

Table 3.1. Comparison among different methodologies and access indicators provided, Same District results, 2006.

4. DISCUSSION

After presenting how the information acquired through WPM can be converted into reliable indicators, this section discusses the applicability of this methodology at a higher scale for monitoring access at the national level.

4.1. Can water point mapping indicators be described as EASSY?

As we have argued in the introduction, indicators used for monitoring the water sector should be EASSY (Easy to get at local level, Accurately defined, Standardized and internationally applicable, Scalable at all administrative levels, Yearly updatable). In the following section the WPM indicators previously presented are analysed based on five characteristics:

- Easy to get at local level and Yearly updatable: After the baseline is established it is possible to update data at the local level. New water points and updated information on existing ones (such as functionality, seasonality and management) should be reported by implementers and is relatively simple to do. The integration of an efficient routine information collection system is crucial if the use of indicators is to be successful; these systems are often in place but are ineffective. The problem is the difficulty for the reporting authority in collecting reliable information from users. This problem does not stem from the indicators used for this WPM, but it is common for every monitoring system to be put in place. However, the issue of quality measurements requires further discussion. It is unreasonable to expect users to update quality measurements but it cannot be overlooked. With a global picture and an established baseline, the responsibility of updating quality measurements could be assigned to a certain body (e.g. basin organs). A number of key measures should be included in the yearly routine (from tank distribution to large-scale projects, and groundwater measurements where there is a high risk of underground contamination, etc.) and be accounted for in the indicators.

- Accurately defined and Scalable at all levels: Once the level of service is defined, the methodology provides a simple way to calculate the access to improved water points. The results are objective and comparable among administrative levels and countries. The limitation for representing data is the availability of geographical information. For example, in Malawi, digital maps exist at the enumerator area level (500 to 1500 people), whereas in Tanzania they are only available at the ward level (10,000 to 20,000 people), which is the administrative level with accepted legal spatial boundaries. In any case, the methodology has a bottom-up approach that allows simple integration from the lowest level upwards.
- Standard and internationally applicable: There are no internationally agreed access indicators. As explained above, countries have different definitions in their policies for access (related to distances) and different quality standards. The WPM methodology helps define and measure access indicators in an objective manner; these indicators can then be applied everywhere and allow water access situations to be effectively compared between countries.

4.2. Can WPM be adopted?

The information provided by WPM is more accurate and easier to present than the indicators currently in use. Despite this, WPM has not yet been adopted widely as a sector-monitoring system in any of the countries where pilot studies have taken place. Arguments usually made on technical grounds against WPM are the following:

- The baseline is expensive at a cost of 12-15 dollars/water point for standard water point mapping (Stoupy et al., 2003) and around 20 dollars when quality analysis is included. This might appear high, but it is not so if important investments are foreseen in the sector. About 2 million dollars for data collection would be needed for Tanzania, for example, while 950 million dollars will be invested in the sector from 2007 to 2011. Moreover, the whole process, including quality measurements, may cost considerably less if the methodology is scaled up, a process which is explained elsewhere (Jiménez and Pérez-Foguet, 2007).

- Data treatment is expensive and complicated. It is well known that the most costly part of setting up databases is information collection. Once developed, a database is easy to use and to update. GIS software licences can also be avoided, since several open source programmes are available and widely used.
- The capacity for managing information has to be in place. This may be the most problematic aspect of establishing the system. Technical and human resources must be placed at the lowest possible level, depending on the particular conditions of each country. Ideally, the decentralized body responsible for water service planning and delivery should be able to manage this information. Alternative solutions are possible, however. Standard information packages (such as maps displaying the density of water points per area and others) could be prepared and sent to both these bodies and users and be used as tools for planning and accountability. Planners at the local level could benefit from these services from upper level bodies (e.g. the Ministry). Once the strategy is defined, targeted capacity building should be put in place to enable technicians to use these tools and to allow users to understand them.

Despite technical challenges, it is important to consider that information is politically sensitive. An in-depth analysis provides less optimistic figures than those given by central governments (Table 3.1). This can be perceived as a threat, making governments reluctant to adopt the system. Pressure from donors and civil society to increase accountability must be encouraged to effectively tackle this problem.

5. CONCLUSIONS

International agreements aim to halve the number of people without access to safe drinking water and basic sanitation by 2015. However, current indicators of access to water are insufficient to measure this in any reliable way. More recently, with the ongoing decentralization processes, and with more than 70% of funds for the sector expected to be channelled through national governments in the next few years, the importance of monitoring national water sectors using EASSY indicators (Easy to get at local level, Accurately defined, Standard and internationally applied, Scalable at all administrative levels, Yearly updatable) has increased. The water point mapping methodology is presented as an alternative way of defining an EASSY water access indicator. Promoted and widely developed by WaterAid, the methodology enables geographically related indicators to be defined and thus determine the level of inequity regarding the distribution of water points. Moreover, the questionnaire attached to every water point means that information from functioning water points and already non-functioning water points can be separated, giving a more precise picture of the situation, especially when more than 30% of the constructed water points become non-functioning (GoT, 2002). Consequently, Functional Improved Community Water Point Density in a particular territory, displayed via digital maps, provides a much better representation of the access situation than ever before. Despite these important advances, some important aspects of access continue to be overlooked: the quality of water served ("safe") and to what extent the service provided by a certain water point is reliable ("sustainable"). The research presented in this paper assesses both aspects and includes them in a new indicator, defined using the same WPM methodology: Bacteriological Acceptable and Yearly-round Functional Improved Water Point Density. This indicator includes new basic quality information collected during mapping campaigns (with a reduced total cost) and processes seasonality data.

Evidence from the Same district in Tanzania reveals significant differences in coverage data when these aspects are included (from 50% to 40% when doing a mapping in relation to usual household surveys, and from 40% to 25% when basic quality and sustainability are included). Given the fact that results from one district are not representative of an entire nation, the aim of the indicator is to highlight two aspects: firstly, that the common assumption that improved water points give safe water may be too optimistic, and secondly, that the vulnerability of rural water services both to climatic events (e.g. droughts) and to inappropriate water use (e.g. source deviation for agriculture, etc.) is usually high. Both aspects are sufficiently important to be included. Water point mapping offers a cost-effective and reliable way of integrating them into a single indicator.

Despite some technical challenges required to adopt this methodology and construct access indicators, political obstacles are the most significant. Internationally agreed basic indicators were long ago defined for other social services such as health. The will of having a reliable monitoring system in the water sectors should be high on the agenda

for international donors and for the governments of developing countries. Furthermore, indicators will be well updated as far as all stakeholders involved perceive a certain degree of usefulness in them. Appropriate investments in capacity building and awareness up to the user level are required for effective implementation. Moreover, the ability to use water point mapping to increase investment efficiency and accountability at the local level will determine to what extent a reliable process for updating can be expected both from users and from decentralized authorities.
In the definition of the methodology presented in this report, geographical information and a bottom-up approach are included, thus allowing further improvements that may benefit other access-related aspects that have not yet been considered. Further improvements to measure quality and more sustainability related information are also needed.

CHAPTER 4

Quality and seasonality of water delivered by improved water points in rural Tanzania

ABSTRACT

This chapter. reports the findings of two water point mapping studies carried out in the Same and Kigoma Districts of Tanzania that covered 2509 water points and around 840000 people . The studies added basic quality parameters and characterization of the seasonality of services to the data collected in standard water point mapping campaigns. Both quality and seasonality results have been analyzed disaggregated by water point technology. The results are extrapolated to three regions of central Tanzania, involving 5921 water points and 4.25 million people(almost 15% of the country's total rural population) in order to highlight the influence that consideration of these factors would have on national coverage figures. The study shows that more than 50% of functional improved water points can be expected to have either quality or seasonality problems, which is in agreement with similar studies already presented in the literature. Thus, 'access to sustainable and safe water' cannot be considered equivalent to 'access to improved water points', the standard and currently accepted indicator for international monitoring, which drives water supply policies in many developing countries. There is a strong need to apply simple and efficient methodologies, as the one presented here, for including quality and seasonality measurements in the water sector information routines in developing countries.

This chapter is based on

Jiménez, A., Pérez-Foguet, A., (2009b). Access to safe and year round functional water: an estimation of coverage for three central regions in Tanzania*. Proceedings of the 34th WEDC International Conference, Addis Ababa, Ethiopia, 2009.*

1. INTRODUCTION

Despite its growing importance, the issue of water quality has long been nearly absent from debates in the developing world (Biswas, 2005). The relevance of safe water for disease prevention is widely recognized (Fay et al., 2005; Fewtrell et al., 2005), but practical problems arise when attempts are made to define and monitor safe water. One of the first difficulties is the establishment of acceptable parameters. These parameters vary from one legal framework and organization to the next, since the public institutions responsible for them are influenced by economic and political factors (Reimann and Banks, 2004), as well as by their own environment. This has resulted in relatively higher arsenic tolerances in India and higher fluoride tolerances in Ethiopia or Tanzania, for instance. Another problem has to do with the frequency of supervision that can in fact be implemented. In general, smaller population centres receive less attention, since potential problems are considered to affect fewer people and resources are limited. This occurs as well in developed countries, where the microbiological quality of drinking-water from small rural systems is much worse than that from large systems (Hunter et al, 2009), and in some places a significant proportion of users perceive some degree of risk in drinking water from the tap (Turgeon et al, 2004).

Recently, it has been argued in development arena that quality of the water delivered at the tap might not be so important (and thus not so important to measure) if users can treat their water at home, through household water treatment (HWT) systems. Despite the potential of HWT to improve the quality of the water consumed, certain issues must be taken into account. First, the effects of HWT on health have not yet been sufficiently documented (Schmidt and Cairncross, 2009), and acceptability (Luby et al., 2008), scalability and the feasibility of private sector involvement (Johnson et al, 2008) are still uncertain. Moreover, contrary to the common situation in urban areas, the willingness to pay in the rural areas will not be always high enough to ensure that the households invest in improving quality of water delivered (Vasquez et al, 2009; Ahmad et al., 2005). Unconditional support for this approach would in fact shift the responsibility for the safety of the water to the citizens themselves, which is controversial to say the least, both from a basic service approach or from a rights-based point of view (UN, 2002).

Additionally, the WHO and UNICEF Joint Monitoring Programme for Water Supply and Sanitation (JMP), in charge of measuring the fulfilment of the Millennium

Development Goals, is also not considering the issue of water quality to a great extent. The indicator used by the JMP for Target 10 (halve, by 2015, the proportion of people without sustainable access to safe drinking water and basic sanitation) is the number of people using improved water sources (WHO/UNICEF, 2000, 2005, 2008). Information is collected through general household surveys and national censuses. The assumption is that certain types of drinking water sources are likely to deliver drinking water of adequate quality for basic health needs (WHO, 2006). In recent questionnaires two questions about water treatment at home (whether it is done and what kind of method is used) have been added. These last two questions are used to establish a baseline for household water treatment (HWT) rather than to assess the quality of the water consumed. As of its latest report, the JMP considers water piped into a dwelling, plot or yard from other improved water points as a separate step in the 'water service ladder' (WHO/UNICEF, 2008), but still calculates access to safe, sustainable water in terms of access to improved water points. The JMP announced that quality tests would be introduced in the monitoring programme through the Rapid Assessment of Drinking Water Quality (RADWQ) protocol, to be tested initially in six countries (Hueb, 2006; van Norden, 2007), but the results of this test were not published and the methodology was not adopted.

Sustainability is widely considered a broad, complex challenge that in rural water supply domain, has attracted a number of general manuals (Harvey and Reed, 2004) as well as programs' analysis (Giné and Pérez-Foguet, 2008) and specific case studies (Hoko and Hertle, 2006). As relates to water systems, sustainability refers to the permanence of water services over time. Many environmental and social factors affect sustainability, and most of these are interdependent. Hence, it is quite difficult to measure sustainability with just a few questions. Nevertheless, attempts such as the sustainability snapshot (Sudgen, 2001) and the sustainability check (Godfrey et al., 2009) have been made to grasp key aspects of this concept. No information is collected about the sustainability of the service from the JMP.

The consequences of all this is that water-related information management systems are being rolled out in many countries (WSP,2006, 2007) albeit with very little regular quality or seasonality testing on the routines. The assumption that improved water points are providing sustainable access to safe water needs to be checked, as this is one of the major drivers of water supply policies in developing countries.

This chapter addresses the relationship between access to improved water sources, the quality of the water delivered and the seasonality of water sources. Our results are based on a field study that assessed 2,509 water points in two rural districts of Tanzania, Same (2006) and Kigoma (2008), serving 838 594 people. Quality and seasonality results by water point category are presented. The discussion section addresses how the consideration of these issues would affect national coverage data, throughout an extrapolation of obtained results disaggregated by technology type to the central regions of Dodoma, Tabora and Singida. Available water point mapping data from those regions (5,921 improved water points serving 4.25 million people) is used as a basis for extrapolation processes. In the conclusions section, we make some policy recommendations.

2. MATERIALS AND METHODS

2.1. Field study: Enhanced Water Point Mapping

The methodology used for the field study has been called enhanced water point mapping (EWPM), and it is based on the mapping activities developed by WaterAid and other agencies in many countries in recent years. Water point mapping (WPM) can be defined as an 'exercise whereby the geographical positions of all improved water points in an area are gathered in addition to management, technical and demographical information. This information is collected using GPS and a questionnaire located at each water point. The data is entered into a geographical information system and then correlated with available demographic, administrative, and physical data. The information is displayed using digital maps.' (WaterAid, ODI, 2005). This methodology was developed as an answer to the absence of reliable and scalable information (Jiménez et al, 2009). The main function of WPM is to simply and objectively demonstrate how water points are distributed within a territory; thus, it serves as a valuable analysis and planning tool for decentralized governments that can improve efficiency and accountability. Geographical information systems have also an important potential to further involve end users and improve participation, as it is being already applied in the water sector (Jankowski, 2009; Ramsey, 2009). Moreover, it helps to define reliable access indicators constructed from the lowest geographical level using the available data (Jiménez and Pérez-Foguet, 2008; Pascual et al., 2009).

The EWPM complements the campaign with two additional actions; i) water quality tests were carried out using portable DelAgua water testing kits; ii) the seasonality of water points was assessed by means of direct questions to users. The quality of all isolated functional water points was tested. Networks were examined at the tank at either one or two distribution points, depending on their size. The quality between those points of measurement was then compared and, if the results were concordant, the bacteriological quality of the water at the delivery point was deemed to be the same for all water points of that network. The assumption was that small rural networks are mainly contaminated between the source and the tank, with much less contamination occurring in the distribution networks themselves. In total, 49 tanks serving networks were analysed. Only two of the tanks gave bacteriological contamination results that were significantly different from those of the water point they serve. The parameters that were measured include pH, turbidity, chlorine, electrical conductivity and concentration of faecal coliforms.

Water point risk assessments were not carried out during the campaign, despite the fact that they are widely recommended (WHO, 1997; Howard, 2002) and used in other monitoring programmes (GoFDRE, 2008). There are various reasons for this. Surveillance of this sort can be done easily for wells and boreholes. When networks are involved, however, a visit to the catchment would be necessary, and that would substantially increase the time and costs of the survey, since many catchments are quite remote and difficult to reach. Moreover, sanitary surveillance is useful as an entry point to a community action plan, but it requires further involvement, beyond that of the consultants performing the survey. Instead, another approach was adopted: when water quality problems are detected, the district water department should make monitoring visits, facilitating sanitary surveillance and definition of community action plans.

We acknowledge that these measurements are very basic (in both frequency and scope) for the purpose of drawing conclusions on the quality of the water delivered. These measurements should be considered a starting point to understanding the situation in each village. They should be complemented by specific measurements (of arsenic, fluoride, metals, etc.) when such a risk is known to exist in a certain area (Tekle-Haimanot et al., 2006; Cortes-Maramba et al, 2006; Mora et al, 2009). Nevertheless, our intention is to promote easy-to-adopt initial steps for the routine measurement of the quality of the water delivered, to facilitate the progressive implementation of the international recommendations on quality surveillance in rural water supplies (WHO, 1997).

In order to determine seasonality, the person responsible for each water point was contacted directly. A water point was not considered to be functional year-round if the water users reported a seasonality of more than one month. Although seasonality measurements alone are not enough to assess the sustainability of a service, the year-round reliability of the source is a necessary condition for it. We recognize that survey respondents can be over-influenced by the events of recent seasons. This bias was reduced by surveying up to three people at each water point.

In Same District, field work lasted 29 days. A total of 723 water points were mapped over an area of 5186 km^2, and 136 valid water quality tests were carried out. In Kigoma District, field work lasted 40 days. A total of 1066 water points were mapped over an area of 19 574 km^2 (of which 8029 km^2 is covered by water), and 112 water quality tests were carried out

.

2.2. Definitions

An improved community water point (ICWP) is a place where water is drawn for various uses, such as drinking, washing and cooking, that has some improved facilities (Stoupy and Sudgen., 2003). This study uses the internationally accepted definition of 'improved' water points (WHO/UNICEF, 2000). Access is normally defined by establishing a ratio between the number of people served by each water point and the maximum distance travelled by users to reach it. In Tanzania, this ratio is one water point per 250 people within a radius of 400 m. In order to accurately assess the number of people served using distance as a criterion, the spatial distribution of households is needed, and this is problematic in many cases. However, due to the implementation of periodic sociological censuses, population distribution in administrative structures is usually quite well documented. Thus, access is measured in terms of the number of people served per water point (250), regardless of whether their households are located more than 400 m from the water point. The first indicator of access is improved community water point density (IWPD), which is equal to the number of ICWPs per 1000 inhabitants. In Tanzania, a certain area would be considered to have access if its density is four or more water points per inhabitant, and the percentage of people not served in an area would be proportional to the lack of available water points as compared to that threshold. However, the survey also assesses the functionality of each water point, and this information is included in the definition of access. Consequently, functional community water point density (FWPD) is frequently used as the access indicator.

By including quality and seasonality information, EWPM allows for the definition of further indicators. Bacteriologically acceptable functional community water point density (BAFD) is defined as the number of functional community water points per 1000 inhabitants that provide water with an acceptable concentration of faecal coliforms at the time of the test (below10 CFU in 100ml, according to Tanzanian standards).

A water point is not considered year-round functional if water users report a seasonality of more than one month. Taking this concept into account, year-round functional community water point density (YRFD) is defined as the number of functional community water points per 1000 inhabitants that work at least 11 months per year.

These two concepts can be combined in the indicator bacteriologically acceptable and year-round functional water point density (BA&YR-FD), which measures the coverage by water points that provided good water quality year-round at the time of the study.

2.3. Water point categories used in the study

Water Point Mapping uses three variables to define a water point: source type, water point type and extraction system. These three parameters help to discriminate the type of water point. In this study, water point types have been grouped in four categories, as defined in Table 4.1. “Gravity Fed” category is the most populated, above 92% of total water points, followed by far by “All handpumps” category, with 5.4% of water points . The motorized pumping systems are only present in Same district and represent under 1% of water points tested. The “Other” category encompasses quite a heterogeneous set of WPs (table 4.1). They amount to a total of 1.8% of the water points examined. We acknowledge that establishing more categories could give a more precise picture when extrapolating the results. Gravity water points fed by springs are less exposed to contamination at the source that those fed by rivers or lakes, and have different seasonality risks, and could therefore be separated into a different category. Handpumps may have different quality and seasonality attributes depending on the depth of the water table. Water points into "Others" category have very different characteristics that might affect quality and seasonality. The size of samples has limited some of these alternatives. Additionally, the categories selected are the same as those used by the Ministry of Water to allocate both development and recurrent funds at district level . Respecting the framework of national's water point classification and keeping a simple classification was considered important, as the methodology used intends to be easily adopted in the national information routines.

CATEGORY	DEFINITION	KIGOMA DISTRICT Number of WP	% of sample	SAME DISTRICT Number of WP	% of sample
Gravity Fed	All water points fed by gravity systems, regardless the type of source.	1623	92.27%	550	91.97%
All handpumps	All water points providing water through a hand pump, regardless its brand and the type of well/borehole.	107	6.08%	21	3.51%
Motorized pumping systems	All water points fed by a pumping device operated through any kind of non-manual extraction system, excluding windmills.	0	0.00%	14	2.34%
Others	Protected springs and rainwater-harvesting not feeding networks; water points fed by windmills.	29	1.65%	13	2.17%
TOTAL	All categories	1759	100%	598	100%

Table 4.1. Categories of Water Points defined for the field study and size of samples.

Note: The difference between the number of WP mapped and those showed in the table is explained by two reasons. First, when water points have two outlets, they are being counted as two effective WP. Secondly, cattle troughs and storage tanks are also mapped, but are not effective water points for human consumption and thus not considered in any category

2.4. Methodology used for the extrapolation of results

The results of the two Districts mapped (Same and Kigoma) were extrapolated to 15 districts in three regions of central Tanzania (Dodoma, Tabora and Singida), covered by a WPM study carried out by WaterAid in 2005. The study covered 5921 water points for human consumption for a rural population of 4.25 million people. The following considerations were applied. First, the presence of bacteriological contamination was presumed to be similar in all places for a particular water point category, since human activities (uses near catchments, water point maintenance, inappropriate activities near water point, etc.) are largely the same in rural areas, regardless of geographical location. Secondly, seasonality was presumed to be much more dependent on the geographical and climatic conditions of each place. For this study, we considered that the data from Same (a district prone to droughts) and Kigoma (a rainy tropical district), taken together, represented a medium-risk place, on average. The combination of quality and seasonality of a particular water point cannot be presumed to be the same as that of any other water point. Nevertheless, the combined prevalence found in Same and Kigoma was used as the sample for the abovementioned purpose. The extrapolated results can only be taken as approximate.

Hence, a two-step method was followed. First, the data was analysed and divided into the technology-type categories defined above. It was then extrapolated, for each category, to all 15 districts. Extrapolation was done both with the most probable failure rate (water quality or seasonality) and with the extreme values of the confidence interval with a significance level of 0.9. The significance level of a confidence interval is the minimum probability of finding the real value in a given interval. The confidence interval was computed following Leemis and Trivedi (1996), in order to properly consider samples and indicators with a reduced number of cases. Table 4.2 shows the data used for extrapolation by category. The various categories showed remarkable disparities in terms of quality and seasonality probability, thus providing an enriched picture that can be applied with more confidence to other places.

CATEGORY OF WP	Gravity Fed	All handpumps	Motorised	Others	General
Influence of Quality					
Total FWP with data	1274	29	7	28	1338
WP with TC>10CFU/100ml	376	12	3	6	428
Best scenario	27.41%	25.89%	12.88%	9.77%	29.88%
Worst scenario	31.69%	58.25%	77.47%	37.97%	34.15%
Most Probable Scenario	29.51%	41.38%	42.86%	21.43%	31.99%
Influence of Seasonality					
Total FWP with data	1339	62	7	37	1445
Seasonal WP(more than one month)	293	14	1	4	312
Best scenario	20.03%	14.20%	0.73%	3.78%	19.82%
Worst scenario	23.82%	33.03%	52.07%	23.05%	23.45%
Most Probable Scenario	21.88%	22.58%	14.29%	10.81%	21.59%
Influence of Quality and Seasonality					
Total FWP with data	1339	62	7	37	1445
WP with bad quality or seasonality	617	25	4	10	656
Best scenario	43.81%	29.80%	22.53%	15.46%	43.22%
Worst scenario	48.36%	51.56%	87.12%	41.52%	47.59%
Most Probable Scenario	46.08%	40.32%	57.14%	27.03%	45.40%

Table 4.2. Quality and Seasonality data used for extrapolation

3. RESULTS

This section presents the results of the WPM study for Kigoma and Same districts. First, the coverage figures are analysed by considering the parameters described above. Secondly, quality is assessed by water point category, and compared with the users' perception of quality. Finally, seasonality results are analyzed.

3.1.Estimation of coverage, including quality and seasonality

Table 4.3 shows the scope and results of the two studies. Historically, Kigoma has received poorer service, with the existing water points (WP) covering just 46.71% of the estimated 2008 population, compared with a figure of 65.06% for Same. Despite this difference, the effect of the distribution and functionality of WP were almost identical (factor of 0.67 in Same and 0.68 in Kigoma), with coverage dropping to 43% and 31%, respectively. The effect of bacteriological contamination for functional water points was also very similar (factor of 0.76 in Same and 0.74 in Kigoma), which means that coverage is reduced by roughly one quarter when the presence of coliforms is considered. Seasonality was greater in Same, as the area is more prone to droughts. When the quality and seasonality aspects are combined, coverage figures drop by similar factors, 0.57 for Same and 0.55 for Kigoma, as compared to the coverage figures that reflect just functionality. All these coverage figures are smaller than those reported by the Tanzanian Ministry of Water.

	Same	Kigoma	Total
Estimated rural population 2008	214502	624092	838594
Effective WP assesed for human consumption	598	1759	2376
Number of valid quality analysis	136	112	248
Coverage reported by GoT (GoT,2008)	51.00%	51.80%	
ICWPD	65.06%	46.71%	
FICWPD	43.37%	31.74%	
BAFD	33.17%	23.44%	
YRFD	31.77%	25.77%	
BA&YR-FD	24.90%	17.50%	

Table 4.3. Scope of the field study and coverage results obtained

3.2. Quality test results by water point category

Table 4.4 shows the results of the quality tests. The critical parameter, presence of total coliforms, was similar in both cases. Of the water points studied, 31.25% had values above Tanzanian standards in Same, as compared to 30.19% in Kigoma. By category, hand pumps were significantly more contaminated in Kigoma (50.00%) than in Same (30.77%) due to the higher percentage of shallow wells. The results for the gravity-fed category, which had the largest number of samples, were more similar, with 35.00% of water points polluted in Same as compared to 27.40% in Kigoma. The results for motorized systems were only available for Same, since this category did not exist in Kigoma. In 42.86% of the cases, coliforms levels were found to exceed Tanzanian standards. Turbidity was relevant only in Kigoma, since that district is mostly served by surface water. In Kigoma, 31.25% of hand pumps and 9.59% of gravity-fed water points had values above 30 NTU. Electrical conductivity values greater than 1,000 µS/cm were only found for hand pumps. This parameter was more significant in Same, where 46.15% of the water points exceeded this threshold, as compared to 12.50% in Kigoma. None of the water points had a value greater than 2000 µS/cm, the standard temporarily adopted in the country. In Kigoma, an acidic pH affected 52.83% of the water points overall, including 75% of the hand pumps tested and nearly 50% of the water points in all other categories. No conclusions about the reasons behind this fact could be taken with the available data. A comprehensive sampling campaign together with soil composition tests should be made to clarify this aspect.

Similar studies have pointed out significant quality problems at rural water points. In an assessment of shallow wells in Guinea-Bissau (Bordalo and Savva-Bordalo, 2007), 79% of the 28 examined wells did not meet EU standards, with faecal contamination and low pH values being the main factors affecting quality. In a study carried out in Ethiopia covering 70 parameters (Rieman et al., 2003), 78% of the 138 samples examined would not pass EC water quality guidelines, with fluoride being the most conflictive parameter. In that study, faecal contamination was not measured; instead, the presence of NO3 was used as an indicator for such contamination. Unpublished results from the RAQW pilot test in Ethiopia were also similar. Of the 290 boreholes tested, 23.10% had more than 10 CFU/100 ml, as compared to 34.20% of the 155 protected dug wells and 46.70% of the 319 protected springs.

Same District					
CATEGORY OF WP	Total complete tests	TC(>10)	NTU (>30)	EC (>1000 µS/cm)	pH<6.5 or >9.5
Gravity Fed	60	21	1	1	0
All handpumps	13	4	0	6	0
Motorised	7	3	0	0	0
Others	16	2	0	1	0
General	**92**	**27**	**1**	**8**	**0**
Kigoma District					
CATEGORY OF WP	Total complete tests	TC(>10)	NTU (>30)	EC (>1000 µS/cm)	pH<6.5 or >9.5
Gravity Fed	73	20	7	0	36
All handpumps	16	8	5	2	12
Motorised	0	0	0	0	0
Others	17	4	0	0	8
General	**106**	**32**	**12**	**2**	**56**

Table 4.4. Results of quality tests. Values above standards by category of water point and parameter

3.3.Perceived vs. measured quality

The relationship between perceived and measured quality was analysed. Table 4.5 shows that most water was qualified as “clear” by users. In 92.06% of these cases, the turbidity level was less than 30 NTU. This is not surprising, since turbidity is directly observable at high values. Of these cases, 71.96% had acceptable values of microbiological water quality. Coloured water was reported just four times, and it had no relationship to any of the observed parameters. Of the reported cases of salinity, only 30.43% had electrical conductivity values greater than 1,000 µS/cm.

A study conducted on 376 boreholes in four districts of Zimbabwe (Hoko, 2005) also showed no clear correlation between measured parameters and people’s perception of quality. This applied to the relationship between observed unsatisfactory colour and measured turbidity, as well as to the relationship between complaints about taste and measured electrical conductivity. In conclusion, apart from parameters directly related to water appearance, users’ perception of quality does not provide reliable information about actual water quality. This point should be taken into account, since many baselines and studies in the rural areas rely on users’ perceptions to avoid testing costs.

Quality reported by users	WP were analysis was made	WP with measured turbidity under 30 NTU		WP with measured FC under 10		WPwith measured EC above 1000µs/cm	
	Number	Number	% from all	Number	% from all	Number	% from all
Clear	214	197	92.06%	154	71.96%		
Coloured	4	3	75.00%	4	100.00%	0	0.00%
Fluoride	3					0	0.00%
Salty	23					7	30.43%

Table 4.5 Relationship between quality of water measured and opinions reported by users

3.4.The issue of seasonality

Table 4.6 shows the results of the seasonality questions Seasonality was more acute in Same (30.1% of the water points) than in Kigoma (18.3%). This was expected, since Same belongs to the arid north-east part of the country and is known to be vulnerable to droughts (Quinn et al, 2003; The Guardian, 2006, 2009). The gravity-fed category was the most prone to seasonality, in most cases due to the reliability of surface water. In Kigoma, the seasonality of hand pumps was considerable, due to the prevalence of shallow wells.

In another study of 144 water points in Zimbabwe (Hoko and Hertle, 2006), users reported seasonality rates of 65%, 72%, 21% and 29% in four different districts, with great variation from one region to the next.

CATEGORY OF WP	SAME DISTRICT			KIGOMA DISTRICT		
	Seasonal WP	Total FWP	%	Seasonal WP	Total FWP	%
Gravity Fed	111	344	32.3%	182	995	18.3%
All handpumps	0	13	0.0%	14	49	28.6%
Motorised	1	7	14.3%	0	0	
Others	1	11	9.1%	3	26	11.5%
General (regardless category)	113	375	30.1%	199	1070	18.6%

Table 4.6.Results of seasonality of water points by category

4. DISCUSSION: EFFECTS ON COVERAGE DATA: AN EXAMPLE OF EXTRAPOLATION TO THREE REGIONS IN TANZANIA

This study aims to highlight the importance of including quality and seasonality in sector routine indicators. We therefore extrapolated our results to 15 districts in three regions of central Tanzania (Dodoma, Tabora and Singida), covered by a standard WPM study carried out by WaterAid in 2005. These regions host a rural population of 4.25 million people (almost 15% of the country's total rural population).

Figures 4.1 to 4.3 show the results of the extrapolation. Figure 4.1 shows the expected coverage (including quality, BAFD) grouped by region and by the three scenarios considered. Figure 4.2 shows the results when seasonality is included. Figure 4.3 shows a combination of the two parameters.

Figure 4.1 shows that the effect of considering bacteriological water quality almost cuts in half the functional coverage in each region. In aggregate terms, 45% of people served by functional improved water points would be receiving poor-quality tap water in the most probable scenario, with this figure dropping to 29% in the best-case scenario.

Seasonality (Figure 4.2) reduces functional coverage by approximately one third in each region. In aggregate terms, 27% of people served by functional improved water points would be using seasonal sources in the most probable scenario, with this figure dropping to 19% in the best-case scenario.

When the two effects are combined (Figure 4.3), we find that between 37% and 67% of the population receiving communal water service is affected by poor bacteriological quality and/or seasonality problems, with 53% being the most probable figure. For the regions studied, this would mean that 1,567 out of 2,982 functional water points are affected by these parameters. In demographic terms, 9.21% of the area's total rural population would be drinking unsafe and/or seasonal water.

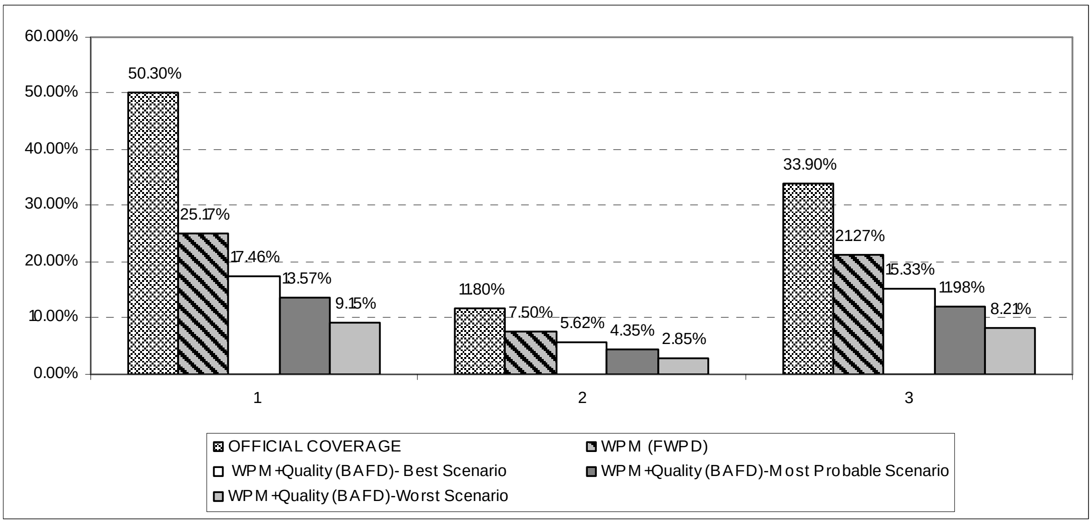

Figure 4.1. Access to water by region after different sources: GoT data, standard water point mapping (WPM) and estimated access when including bacteriological quality of water delivered

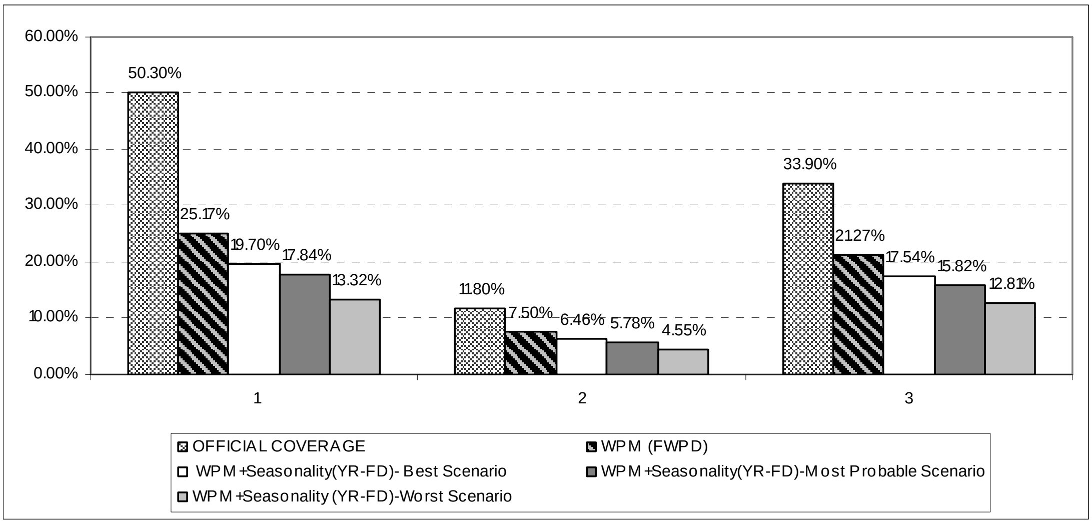

Figure 4.2. Access to water by region after different sources: GoT data, standard water point mapping (WPM) and estimated access when including seasonality of water delivered

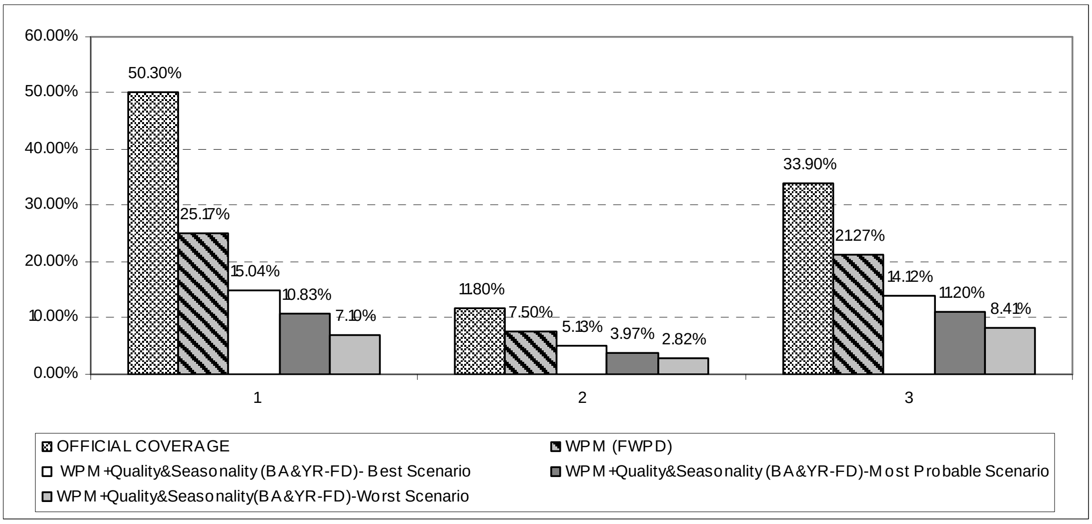

Figure 4.3. Access to water by region after different sources: GoT data, standard water point mapping (WPM) and estimated access when including bacteriological quality and seasonality of water delivered.

5. CONCLUSIONS

The measurement of water service quality is an important challenge in developing countries. Despite being included in the definition of the MDG target (sustainable access to safe drinking water) and having long been recognized as a key aspect by the WHO, the Joint Monitoring Programme does not include this factor in its measurements. The current focus on household water treatment has probably drawn some attention away from this problem by shifting the responsibility (and costs) of safe water to the end users. Additionally, sanitary inspections of water points have in some cases been adopted as the only action related to water quality. Despite being meaningful tools, they cannot be taken as the only testing instrument. Seasonality of water sources is a factor of growing importance in rural water supplies, especially in current climate scenario (Paavola, 2008).

This study presented some insights into the relationship between access to improved water sources, the quality of the water delivered and the physical reliability of the services, by technology category. The presence of coliforms is a the most relevant of water quality problems found. When information is disaggregated by category, about 40% of ground water points were found to be polluted together with 30% of gravity-fed systems. Seasonality is also affecting the services up to 30% of cases, depending on category and geographical location of the water point. If we assimilate the results to the networks they belong to, coverage is reduced by one quarter when the presence of coliforms is considered, and between 20 and 33% with seasonality. When both the quality and seasonality aspects are combined, coverage figures dropped by a factor of 0.57 and 0.55 for the districts studied, as compared to the coverage figures that reflect just functionality.

The extrapolation of the data to a wider area showed that the various aspects have an enormous impact on water access figures. The ‘access to sustainable and safe water’ might not be equivalent to ‘access to improved water points’, the standard currently accepted for international monitoring. Around 50% of functional improved water points can be expected to have either quality or seasonality problems. Simply because it is not being measured, this fact is currently being ignored at all decision-making levels related to water policy. No actions are being taken to correct this situation, which significantly impacts the health and well-being of millions of people. Including simple quality and seasonality measurements in routine data collection, as presented here, is a necessary step towards addressing the problem. And hopefully, more flexible and holistic service provision strategies will be taken afterwards.

CHAPTER 5

Consequences of low sustainability in national rural water supply plans.

ABSTRACT

Tanzania, like many other countries, has designed an ambitious Rural Water Supply and Sanitation Plan (RWSSP) to improve and increase access to water from 53% in 2005 to 90% by 2025. The country has emphasized the development of new schemes, allocating just 6% of investments for rehabilitation and 4% for district management support and capacity building. This strategy clashes with the current water point functionality-time relationships found in an extensive water point mapping study conducted in three regions of Tanzania that account for 15% of the country's total rural population. In this study, functionality- and management-related water point mapping questions were disaggregated by both technology category and administrative structure, and appropriate scales of analysis of the various relationships were justified (i.e. functionality at the district level; functionality-time and functionality-management relationships at the supra-regional level). The results showed very low performance of water points over time: just 35% to 47% of them, depending on the technology considered, were working 15 years after installation. The consequences for the success of the RWSSP are quantified and discussed, and some measures are proposed.

This chapter is based on

Jiménez, A., Pérez-Foguet, A., (2009c). Consequences of low sustainability in the effectiveness of national strategies to increase water access in the rural areas: evidence from three central regions of Tanzania. *Proceedings of the 1st IWA Development Congress, México, 2009*.

1. INTRODUCTION

The sustainability of rural water supply programs in developing countries is a key concern for the sector. Current estimations for Sub-Saharan Africa suggest that only two out of three water points (WPs) in the continent's rural areas are functional at any given time (RWSN, 2009), although there are no large data sets available that could back up this estimation. Other sources estimate the functionality of hand pumps at between 40 and 50% (Harvey et al., 2004) based on a wide range of studies in many countries. In Tanzania, 30% of systems have been estimated to be non-functional (GoT, 2002). Although this problem was identified long ago (Rao et al., 1987; Muyibi, 1992), emphasis is frequently still placed on the fast development of new schemes, many of which stop working in a very short period of time. The Tanzanian government, like many others, has undertaken an ambitious plan to improve and increase access to water. This plan, known as the Water Sector Development Program (WSDP), includes three sub-programs: Water Resources Management and Development, the Rural Water Supply and Sanitation Plan (RWSSP), and Urban Water Supply and Sewerage. Tanzania currently has an estimated rural population of 25.9 million and the reported rural coverage is 53%. The RWSSP establishes the following targets: the percentage of rural populations with sustainable and equitable access to safe water will be: 1) at least 65% by 2010 (a goal set by the National Strategy for Growth and Reduction of Poverty, also known as MKUKUTA); 2) at least 74% by mid 2015 (as specified by the Millennium Development Goals); and 3) at least 90% by 2025. The fulfillment of these targets will require extending water supply coverage to an additional 33.8 million people from 2005 to 2025. The estimated costs for the rural component (excluding small towns) are US$1.6 billion, with US$1.4 billion for capital investment, US$51 million for management and operational support to districts, and nearly US$17 million for institutional strengthening and development (GoT, 2006).

The absence of adequate information systems makes it difficult to extensively analyze the real sustainability of rural services. To address this lack of information, a water point mapping (WPM) approach was specifically designed to measure access indicators, as it has been described in previous chapters. Table 5.1 shows the differences in coverage found by a WPM study carried out in 2005 and 2006 in three regions of central Tanzania (Dodoma, Tabora and Singida). It includes the analysis and mapping of 6,814 WPs in 15 districts, an area with a rural population of 3.95 million people.

.

DODOMA			
District	Rural Population	Coverage through WPM	Official Data
Kongwa	248.656	29%	74,40%
Mpwapwa	253.602	29%	65%
Dodoma Urban	242.771	25%	38,20%1
Dodoma Rural	438.866	23%	51,20%
Kondoa	428.090	23%	38%
Dodoma Region	1.363.329	25%	61%
TABORA			
District	Rural Population	Coverage through WPM	Official Data
Nzega	415.203	12%	25,10%
Tabora Urban	91.261	10%	10,90%1
Uyui	281.101	7%	10,70%
Urambo	369.329	6%	14,40%
Igunga	324.094	5%	9,00%
Sikonge	132.733	3%	4,60%
Tabora	1.613.721	8%	14%
SINGIDA			
District	Rural Population	Coverage through WPM	Official Data
Singida Town Council	56.949	66%	32,00%1
Singida Rural	400.377	21%	39,40%
Iramba	367.036	17%	30,00%
Manyoni	204.482	17%	36,40%
Singida Region	971.895	21%	37%

Table 5.1. Comparison between the access to water obtained from WPM and the official figures

Note 1: The coverage data for Urban Districts is given for the rural part of it, in order to make figures directly comparable.

The sustainability of the RWSSP approach was recently assessed in terms of overall design and policy (Giné and Pérez-Foguet, 2008). This paper assesses how the low durability of rural water supplies influences the effectiveness of the RWSSP. Data on sustainability rates are taken from the abovementioned WPM study. An analysis is carried out at various geographical scales, down to the district level. The aim of this paper is to highlight the risk of underestimating the huge non-functionality rates currently observed in the definition water development plans. It also underlines the importance of tackling the issue of sustainability in rural water supplies and provides insight into the relationship between functionality and category of WP.

2. METHODOLOGY

First, the influence of technology on the functionality rate is estimated from observed data. WPs are grouped into four main technology categories: hand pumps of all types, motorized systems, gravity-fed systems and "other." The relationship between functionality rates, years passed since construction and technology category is presented in the results. Management-related questions are also assessed in terms of functionality and WP category. All relationships are analyzed at multiple spatial scales. To do this, we used Pearson's chi-square test (computing the exact level of significance when possible), with either the overall sample or a reduced one without "unknown" or blank responses for questions on management or year of construction (5,139 WPs). Equivalent results were obtained with the two samples, as it will be explained. The best scales for establishing dependence conditions are justified.

The discussion presents the estimated future access (in 2015) in the three regions calculated by applying the previously obtained functionality-time function to the new investments planned by the government in the RWSSP for the aforementioned districts and period. Implications and recommendations are given in the conclusions.

2.1. WP technology

The different types of WPs were grouped in four categories, as shown in Table 5.2. The reasons for establishing these groups are as follows. Each category has a very different set of management problems that are similar among the WPs in the category itself. Hand pumps, regardless of the depth and type of well, face similar management problems: the relatively small groups of users and the difficult access to spare parts are the main challenges for the rural population. Gravity-fed systems usually serve a larger number of people through a network. WPs suffer from poor maintenance and low financial contributions and usually face problems related to catchment management (e.g. poor quality and seasonality of water service). Motorized systems serving a network face the challenge of high running costs and technology dependence, which requires a high degree of community involvement in management from the outset. The "other" category encompasses quite a heterogeneous set of WPs. This category was not subdivided because it accounts for only 2.6% of the WPs mapped. The sample for this category is too small for any conclusions to be reached. The selected categories are the same as those used by the Ministry of Water to allocate funds for recurrent costs at the district level (GoT, 2006b).

		CENTRAL REGIONS	
CATEGORY	DEFINITION	Number of WP	% of sample
All handpumps	All water points providing water through a hand pump, regardless its brand and the type of well/borehole.	2326	39,3%
Motorized pumping systems	All water points fed by a pumping device operated through any kind of non-manual extraction system, excluding windmills.	2180	36,8%
Gravity Fed	All water points fed by gravity systems, regardless the type of source.	1263	21,3%
Others	Protected springs and rainwater-harvesting not feeding networks; water points fed by windmills.	152	2,6%

Table 5.2: Water points analyzed grouped by category.

These categories facilitate data analysis by making it possible to group, in a meaningful and understandable way, all possible combinations of water types, source types and extraction systems. In addition to the abovementioned WPs, 511 cattle troughs were mapped and 382 points could not be put into any category due to contradictions or non-responses to survey questions. Of these points, just 49 were functional WPs. Hence, a sample of 5,921 WPs was used.

3. RESULTS

This section presents the results for the 15 districts studied, as described in the methodology.

3.1. Functionality by category of WP

Functionality by category does not vary greatly in general terms. The functionality rates were 45.31% for hand pumps, 48.61% for gravity-fed systems, 44.36% for motorized systems, and 36.18% for other systems.

When the information is disaggregated in each of the districts, the results are more variable, as shown in Figure 5.1 (districts are named by numbers). If a district had fewer than 10 WPs in a particular category, that category was not represented in order to prevent conclusions from being drawn on the basis of extremely small samples. With this criterion, not all categories are shown in each district. Remarkably different sustainability rates were found for particular types of WPs in neighboring areas, and no standard trends were seen for any technology. Nevertheless, this is not surprising, since many factors other than technology affect sustainability, such as end users' participation (Hopkins et al., 2004; Rajabu, 2005), water governance (Franks and Cleaver, 2007; Cleaver and Toner, 2006) and the ability to meet O&M costs (Harvey, 2007).

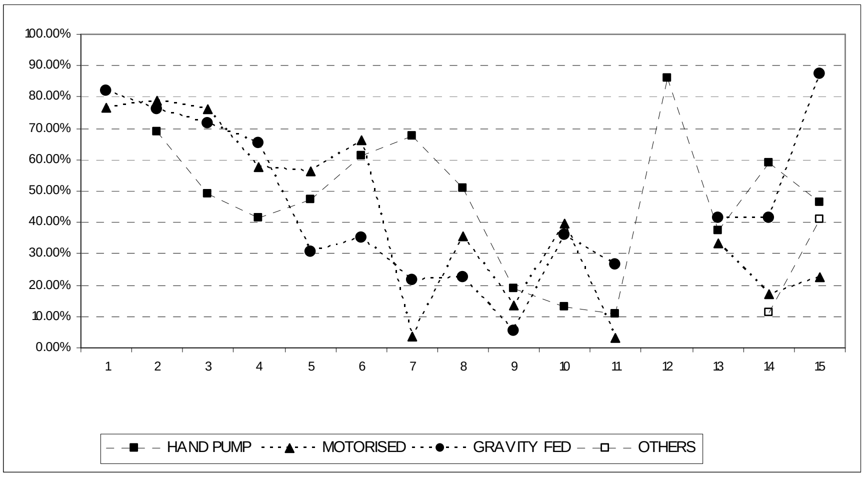

Figure 5.1: Rate of functionality by category of water point and District.

Given this fact, we also determined the statistical dependence relationships between functionality and technology category of WPs at different spatial scales. A clear relationship (significance equal to 0.01) was found with grouped data, as well as with data disaggregated by region (zero significance in all three regions). When information was disaggregated by district, more than two thirds of the districts (11 out of 15) were found to have a statistical relationship with a significance level of less than 0.05. Hence, we can conclude that the functionality and category of WPs are dependent at the supra-regional and regional scales and, to a lesser extent, at the district scale.

3.2. Functionality by category over time

The following methodology was used to analyze the relationship between category and time after installation of the WPs. The WPs were grouped by five-year periods after construction regardless of location. Figure 5.2 shows the average functionality for each group and a trend curve for each category. Hand pumps and motorized WPs have very regular descending functionality-time curves, with R2 values of 0.99 and 0.92, respectively. Gravity-fed WPs show a more irregular trend: the functionality of those built in the early 1990s was very low (less than 40%), while those built between 1985 and 1990 were performing much better (with a functionality of almost 60%), and those built between 1980 and 1985 remained functional in just over 20% of the cases. As a result, the trend curve (R2 = 0.71) for gravity-fed WPs starts with an initial low functionality rate but it has a flatter slope than the others. For the “other” category, the oldest WPs (more than 25 years old) were functional in just 18% of cases, whereas those built in the past five years had a functionality rate of 85%. This trend curve (R2 = 0.76) shows the best response over time for this category of WP.

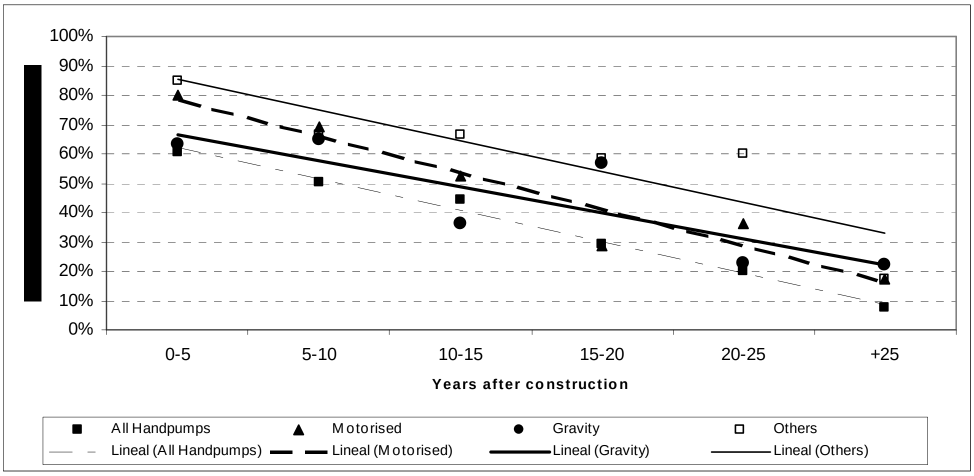

Figure 5.2: Rate of functionality by category of water point over time.

The linear regressions by category yielded interesting results. Surprisingly, hand pumps had the least favorable functionality-time function, dropping from 61% in the first five years to 8% in the 30-year period. Motorized systems started at 79% and dropped to 17% in the same period. Gravity-fed systems worked better in the long run than any other category of WP, dropping from 67% to 19%. In all three categories, just 35 to 47% of WPs were working 15 years after installation. WPs in the “other” category had better scores, but this category included very few WPs (just 152 out of 6,814) and, as explained above, grouped WPs of very different types. RWSSP predictions estimate that 48% of people will be served by hand pumps, 25% will be served by motorized systems and 21% will be served by gravity-flow networks (GoT, 2006c). Thus, sustainability by type of WP is of critical importance, as discussed hereinafter.

In order to determine the most appropriate scale of description, we tested whether functionality and year of construction (lumped in five-year periods up to 30 years, resulting in seven categories) are clearly dependent. This relationship is clear when the overall sample is considered, and also when disaggregated by technology type (except for the “other” category, with a significance greater than 0.2). Nevertheless, we found that functionality and year of construction cannot be confirmed as dependent when disaggregated by region or by district. In contrast with the dependence between functionality and technology category, which was established at the district scale in the previous subsection, common functionality-time relationships were found for the three regions. Relationships are used in the discussion section to quantify the influence of low sustainability on the expected results of the RWSSP.

3.3. Relationship between functionality of WPs and management-related questions

An analysis of the questions dealing with management at the community level did not yield conclusive results. Positive management practices were not exclusive of functional WPs, and conversely, negative ones were not exclusive of non-functional WPs, as one might expect a priori. Table 5.3 shows that meetings were held at a quite similar rate regardless of functionality. Surprisingly, income was reported to be slightly above 50% for functional WPs but 43% for non-functional ones. Only 36.4% of functional WPs reported expenditures for the year prior to the survey, which could indicate poor preventive maintenance of the systems. Fewer than 10% of respondents overall said they did not know whether there had been expenditures. Fewer than 3% declared that the system had expenditures but no income, which could be interpreted as meaning that there is no contradiction between the answers. Finally, 63.7% of the functional WPs that reported income also had expenditures, which seems reasonable for a functional service.

	Last year meetings declared	Last year income declared	Last year expenditure declared
% of Functional WP that	79,5%	54,8%	36,4%
% of Not Functional WP that	68,7%	43,5%	17,5%

Table 5.3: Answers to management related questions for the 15 Districts, regardless category of WP.

Questions were further disaggregated by category (Figures 5.3 and 5.4). Functional motorized systems had the highest rates of income and expenditure (66% and 54%, respectively); however, the opposite makes no sense (How can 46% of them run without expenditure?). Gravity-fed systems had low scores both in income (44%) and expenditure (35%). Functional hand pumps reported expenditures in only 19% of the cases. The results for non-functional WPs (Figure 5.4) did not differ greatly. Meetings took place at a similar rate regardless of the category of WP. Income was collected in 40% of the cases. Unfortunately, the data do not tell us whether this money was to be used for reconstruction, as an initial contribution for another WP, or for other purposes. Expenditures were significantly lower in all categories when WPs were non-functional.

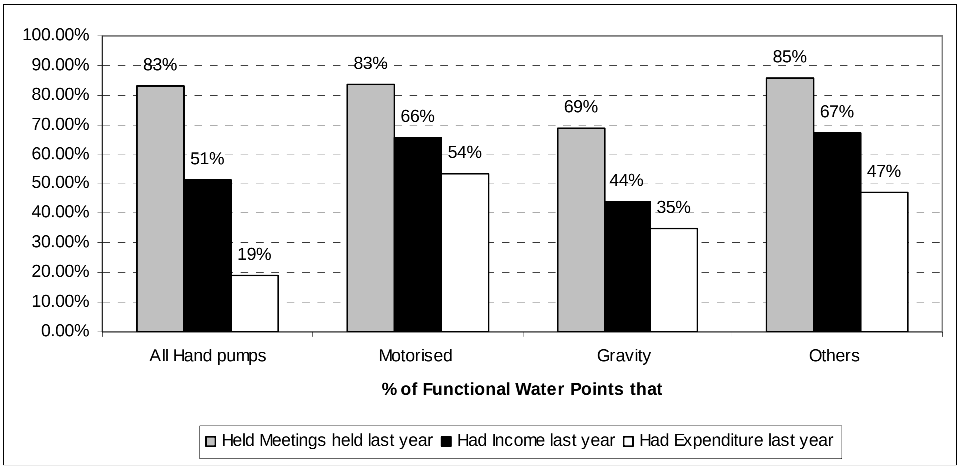

Figure 5.3: Answers to management related questions for functional water points, grouped by category of water points.

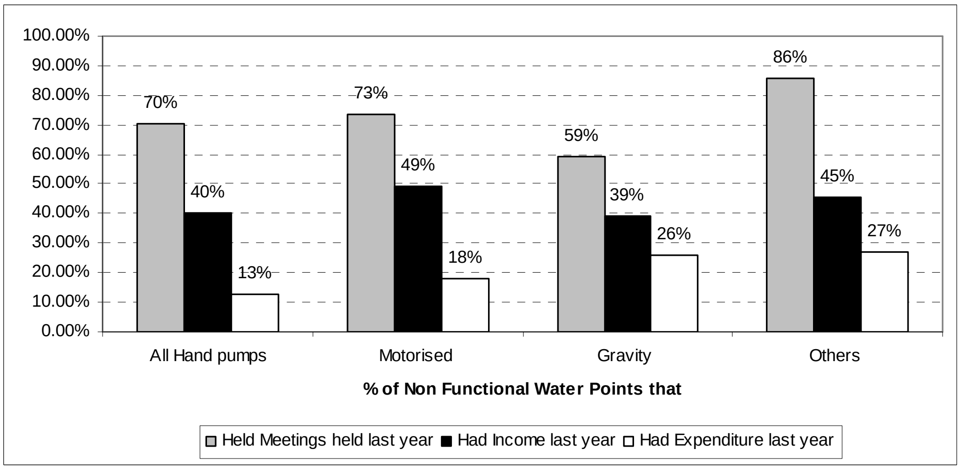

Figure 5.4 Answers to management related questions for non-functional water points, grouped by category of water points.

Management-related questions and functionality were found to be statistically dependent at the supra-regional and regional scales, without considering data disaggregated by technology category, but not at the district scale. When disaggregated by district, only one third of the districts showed a dependence relationship between functionality and meetings and functionality and income. Expenditure showed a slightly higher dependence, with a significance of less than 0.05 in 8 out of 15 districts.

Analyses carried out with data disaggregated by technology category showed that most combinations give dependence associations at the supra-regional level (all but the "other" category and the question about meetings) but, when downscaled at the regional level, just one third of the combinations give significances of less than 0.05. Thus, if disaggregated technology categories are considered (Figures 5.3 and 5.4), the relationship between functionality and management questions is established at the supra-regional scale. Analyses also confirmed that expenditure is the most suitable question for ascertaining how management affects functionality, and, remarkably, in all three regions, the functionality of the motorized WPs was found to be related to the reported expenditure.

Hence, the relationship between day-to-day management practices and the functionality of WPs over time is not simple to establish. Nevertheless, this is a crucial factor for the success of the RWSSP, as presented in the following section.

4. DISCUSSION

4.1.Allocation of resources and calculation of costs in the RWSSP

As mentioned above, under the RWSSP, the government of Tanzania has ambitious targets for increasing access to water throughout the country. This will require the provision of new water supply services and the promotion of sanitation for an estimated 33.8 million residents. The forecasted allocation of resources is based on two general principles:

- Districts with less coverage will receive more funds in order to bring their level of service closer to the national level. As an example, in 2005 the reported coverage by district ranged from 6.4% to 91.8%. The RWSSP aims for all districts to fit in the range 80-95% by 2025.
- The proposed technology mix and costs are based on the current presence of technologies in the districts, combined with a demand assessment study and expert opinions.

The first principle focuses on improving access equitably among districts. Districts that have less coverage are also likely to face more difficulties in keeping new WPs functional. Figure 5.5 shows that there is a fairly good relationship between coverage and the rate of WP functionality at the district level (the linear relationship is stronger if the data are aggregated by region, R2 = 0.86). Another indicator of the relatively low capacity of the regions with less coverage is the relationship between management-related questions and coverage (Figure 5.6). The areas with better coverage are those which perform better in management. These results highlight the difficulty of rapidly increasing the coverage of underserved areas. Critical factors affecting functionality should be assessed in parallel with major infrastructure investments in order to effectively increase coverage. An in-depth analysis of the relationships between functionality and management could help to establish appropriate capacity improvement strategies.

As regards choice of technology, it seems reasonable to promote the same technologies already present in a particular district, since we can presume that the choice in the past was reasonable (when aggregated). Moreover, economies of scale may provide benefits at the district level. Figure 5.7 shows that, on average, the most predominant category tends to perform better than the other categories present in the district (categories with fewer than 10 WPs were not considered for this purpose). On average, the functionality rate of the predominant category is 1.18 times higher than the average for the relevant categories in the district. In just one case (District 15) was the average value significantly higher (more than 10%) than the value for the predominant category. This can only be translated as a recommendation for the end users since the final choice of level of service, which frequently implies the technology of WP, is made by them.

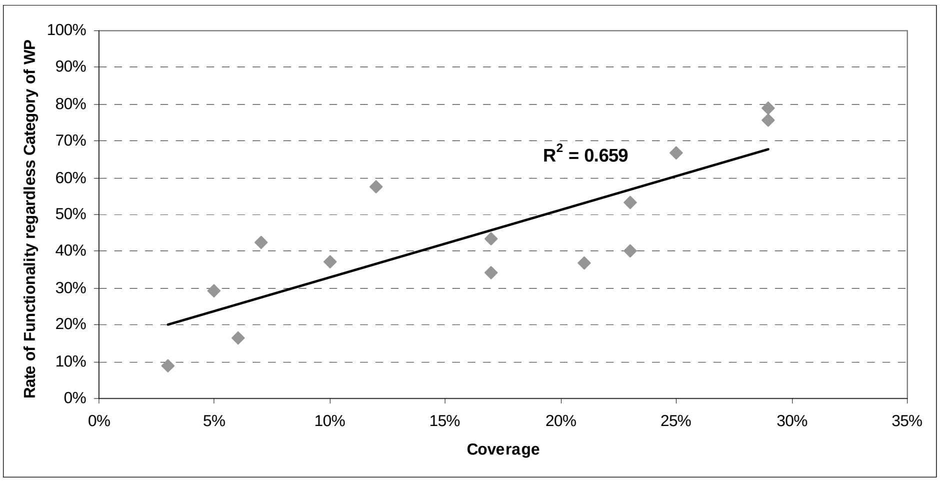

Figure 5.5. Relationship between the coverage of WP and the functionality observed in 14 districts studied (Singida Town was excluded because of its very high coverage compared to others).

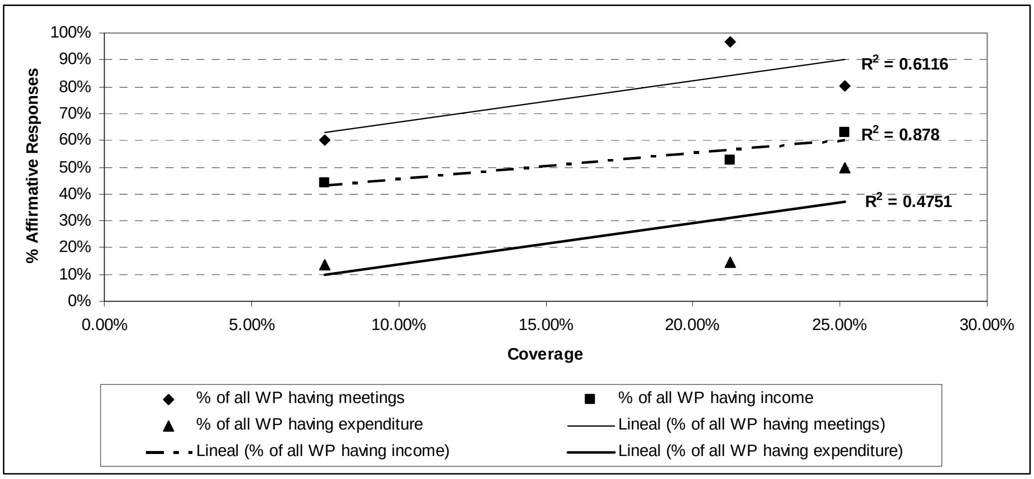

Figure 5.6.Relationship between answers to management related questions and coverage, by Region.

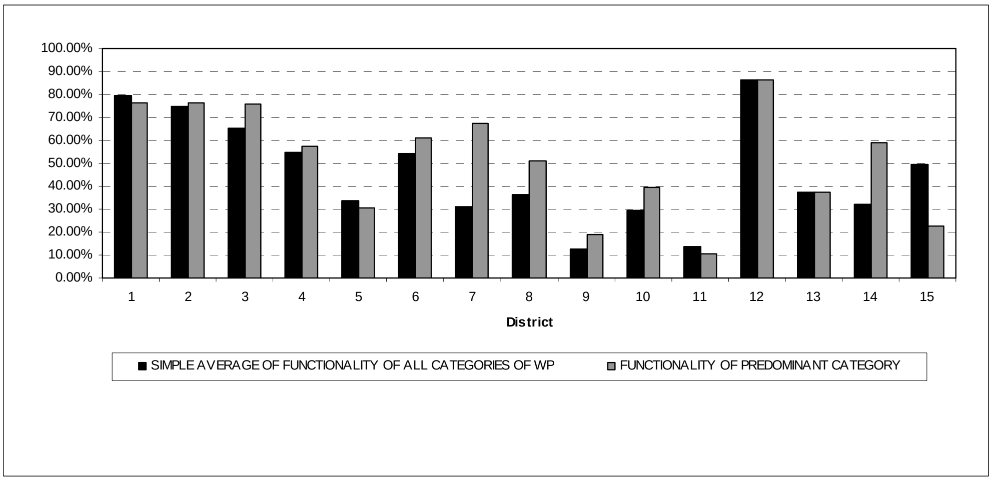

Figure 5.7. Rate of functionality of the predominant category of WP compared to the simple average of functionality of all categories in 15 Districts studied**.**

4.2. The effect of current sustainability rates on national targets

Government investment forecasts for 2005-2025 assume that only 25% of all rural systems in existence in 2004 will require major investments in rehabilitation during that period. Additionally, capital investment in major system rehabilitation is assumed to account for 66% of the cost of new water supply services. As a result of these two assumptions, US$1.1 billion has been set aside for investment in new rural services for 2005-2025 but just US$70 million has been allocated for rehabilitation (GoT, 2006d). Table 5.4 summarizes detailed predictions for the three regions studied: according to national plans, 10,300 new WPs will be built and 1,088 will be repaired from 2005 to 2015.

In this study, the functionality-time functions found for the three regions (Figure 5.2) were used to determine how many WPs would become non-functional over time. For that purpose, the mean functionality rate for each five-year period was applied to each age-based group of WPs, with 2015 taken at the starting year (Table 5.5). The functionality rates of WPs more than 30 years old were estimated at a constant rate of functioning. The planned investments were aggregated from the district level, and functionality-time functions were established at the supra-regional scale, following the results presented in the previous section.

CATEGORY OF WATER POINT	NEW SERVICES		REHABILITADED	
	05-10	11-15	05-10	11-15
All Hand pumps	2781	2516	240	211
Motorised pumped systems	1886	1701	216	190
Gravity	196	168	48	41
Others(windmill, rainwater, springs)	559	493	76	66

Table 5.4 Water Points planned by category until 2015 in the three regions studied

Category of Water Point	More than 25years	20 to 25 years	15 to 20 years	10 to 15 years	5 to 10 years	Below 5 years
All Hand pumps	9%	19%	30%	41%	51%	62%
Motorised	16%	29%	41%	53%	66%	78%
Gravity	22%	31%	40%	49%	58%	67%
Others	33%	43%	54%	64%	75%	85%

Table 5.5 Functionality rates applied to each category of WP depending on their age

Using the estimated population growth rates, the simulation yielded the following results. Of the 17,240 WPs ever installed in the three regions, only 9,009 will be operational in 2015. The RWSSP estimates that 1,088 WPs will be rehabilitated by 2015. As a reference, if current sustainability rates are maintained, 4,059 of the WPs built from 2005 onwards will become non-functional during the same period. This means that more than 742,750 people will be affected by the low sustainability of actions implemented from 2005 to 2015. Coverage will increase in the three regions from 17.5% in 2005 to 39.7% for 2015, meaning that 2,248,229 new people will be served. Government's estimations for the same period project that 3,558,955 new people will receive service with the same investment, bringing coverage to 62.9%. Thus, the effect of low sustainability combined with the inaccuracy of the initial data will result in an overestimation of service coverage to 1,306,652 people, i.e. 23% of total population of the area.

As an example, if the sustainability-time function were increased by 10% in all categories, an additional 262,665 people (5% of the total population) would maintain their access to water over the same period. If it were increased by 15% for hand pumps only, 175,828 people in the three regions would maintain their access to water.

The latest data about the implementation of the pilot phase of the RWSSP (2002-2008) confirms the validity of this simulation (World Bank, 2008). Out of 197 water points examined in 19 sampled systems implemented in 6 districts during the last five years, 130 (65.99%) were functional at the time of the evaluation, with a 75% functionality rate for gravity and 55.91% for handpumps. These values support the estimations made, and show that the functionality-time tendency has not changed with the current implementation model

5. CONCLUSIONS

Like many other countries, Tanzania has designed an ambitious plan to improve rural access to water from 53% in 2005 to 74% by 2015 and to 90% by 2025, with the ultimate goal of providing access to 33.8 million people over that period. The country has emphasized the fast development of new schemes, allocating just 4% of total investments for district management support and institutional strengthening and less than 6% for rehabilitations; the assumption is that just 25% of the services in place in 2004 will need rehabilitation over the 20-year period of the program.

An analysis of the functionality of WPs in three regions of central Tanzania show a very different situation. The functionality by category showed that only 45.31% of hand pumps, 48.61% of gravity-fed systems and 44.36% of motorized systems were functional at the time of the survey. Some WP categories were found to be quite sustainable in some areas and to fail completely in others. Nevertheless, the statistical analysis showed a clear relationship between functionality and category of WP at the supra-regional, regional and district levels.

The analysis found dramatically low functionality rates over time for all WP categories. In aggregate terms, hand pumps had the least favorable functionality-time function, dropping from 61% in the first five years to 8% in the 30-year period. Motorized systems started at 79% and dropped to 17% in the same period. Gravity-fed systems worked better in the long run than any other category of WP, dropping from 67% to

19%. In all three categories, just 35 to 47% of WPs were working 15 years after installation, and 22 to 38% of them stopped working before five years. RWSSP predictions estimate that 48% of people will be served by hand pumps, 25% will be served by motorized systems and 21% will be served by gravity-flow networks.

An analysis of the management-related information provided by the WPM did not show conclusive relationships between meetings, income, expenditure and the functionality of WPs. Statistical analyses found dependence relationships between management-related questions and functionality at the regional scale. Some relationships between coverage and reported expenditure were found, but they were not significant enough for any general conclusions to be drawn.

An analysis by category found that motorized water systems had the best performance in terms of income and expenditure, which is consistent with the high functionality rate found in the first 15 years of service. Hand pumps scored the worst on these questions, which is also consistent with the low functionality-time function found. More research is needed in order to formulate the right questions in the right way and thereby obtain additional management-related information.

Under the RWSSP, resources are allocated in a way that promotes equity among districts. This is a valuable goal in itself, but the study showed that districts that currently have low coverage also have lower functionality rates, i.e. they have more trouble keeping WPs functional over time. Thus, massive investment in new services in these places without significant complementary actions could result in lower coverage than expected in a few years' time. Hence, the 4% allocated to district management support and institutional strengthening seems especially low for the underserved areas.

The determination of costs is based on the technology mix found in each district, combined with a demand assessment carried out in 18 districts and expert opinions. Data from the three regions showed that, on average, the functionality of a district's predominant WP category is 1.18 times better than the average for that district. Thus, it seems like a good strategy to promote, when conditions allow, the predominant WP category, since the district might benefit from local economies of scale.

If current sustainability trends are maintained and investments are distributed as planned (94% for new services and 6% for rehabilitation), the RWSSP's targets will probably not be met. If current trends hold, coverage in the three regions studied would be 39.7% as opposed to the 62.9% forecasted for 2015. The results from the evaluation of the pilot phase of the program (2002-2008) show that the functionality-rate tendency is quite similar to the findings of this study. As an example, if sustainability rates were to be increased by 10% in all categories, coverage in the three regions would increase by 5% in the first ten years of the program.

The study shows that the functionality of services over time must be improved if the RWSSP is to achieve its goals. It is crucial to invest more in management capacities at the community level and in post-project support at the district level. Additionally, a more realistic amount of funds should be allocated for rehabilitations and adequate capacity-building efforts should be made in underserved districts. Adequate supervision of the implementation of works together with a special support plan for the first years of operation of services would serve to protect the investments made. Special attention should be given to hand pumps, since they are expected to serve the largest percentage of the population and their sustainability rate is the lowest found in the study. A sound information system should be implemented in order to monitor real progress and promote the sharing of best practices. Finally, further research should examine factors affecting sustainability in various places in order to be able to facilitate the right type of service for each place.

CHAPTER 6

The challenges of implementing pro-poor policies in a decentralized context: the case of the Rural Water Supply and Sanitation Program in Tanzania.

ABSTRACT

This chapter examines the challenge of achieving a balance between the implementation of centrally designed pro-poor policies and the decentralization of responsibilities to local governments in many developing countries. It analyzes the implementation of the Rural Water Supply and Sanitation Program in Tanzania. Key mechanisms for the planning and allocating resources are analyzed at ministry, district, and village levels. Results show that a mixture of policy incoherencies, technical shortcomings and political influence determine that only a small proportion of funds reaches the underserved areas. We argue that downwards accountability has to be dramatically increased before decentralized decision-making result in better resources allocation. Meanwhile a bigger intervention from central government is needed.

1. INTRODUCTION

In theory, decentralization is a means of improving quality of governance by delegating power to local governments, which are assumed to have better information and more incentives than the central government when it comes to responding to local needs and preferences. It is also supposed to decrease corruption and increase public participation and the accountability of public officials, resulting in poverty reduction (Ford, 1999). In practice, the literature shows very different effects of decentralization on poverty reduction (Shah et al, 2004; OCDE, 2005; Steiner, 2007; Faguet, 2004). The expected outcome depends on existing institutional arrangements and power relations, and on the coherence of decentralization policies in the specific context (Smoke and Lewis, 1996). It is widely accepted that successful decentralization has to do with local government authorities (LGA) being able to take their own decisions and be accountable for them (Shah 1998). But practical implementation of this remains difficult. In many cases, central governments are reluctant to decentralize resources (despite official discourses), and use different mechanisms to retain control (Ribot et al, 2006). On the other hand, when governance is decentralized, local elites are frequently even less likely than national elites to target government resources to the poor (Blair, 2000; Crook, 2003). Moreover, the fervor of decentralized governments to become financially independent through the collection of local taxes can eventually prevent the rural poor to improve their living (Ellis and Mdoe, 2003). Hence, the setting of centrally designed pro-poor policies on health or water backed by sectoral funds is a typical example of policy incoherence in terms of decentralization, but these policies can still be successful and appropriate, even when the benefits that stem from bringing governments closer to the people are not fully exploited (Jütting et al, 2005). The challenge is how these policies can coexist with local participation and autonomy (Francis and James, 2003).

Nevertheless, the poor are not automatically benefited when resources reach the village. Communities are not always ready to target resources to the poor (Galasso and Ravallion, 2005) while these are frequently less able and have fewer channels to participate in those community processes that could eventually improve their living (Cleaver, 2005; Agrawal and Gupta, 2005; Hickey and Bracking, 2005). This has been attested by the irregular experience of community management of common-pool resources (Songorwa, 1999; Blaikie, 2006) and water supplies (Cleaver and Toner, 2006; Harvey and Reed, 2007; Bakker, 2008), which point out the limitations of the leaving the communities to deal on their own with management of resources.

Hence, there is a long way to go from the definition of pro-poor programs to the effective reach of services to underserved households. In that way, decentralized decision making does not always mean a short cut to success. This paper analyzes the Rural Water Supply and Sanitation Program (RWSSP) of Tanzania to show evidence of the challenges of implementation of pro-poor policies in a decentralized context. The key mechanisms for planning and allocating resources from the ministry down to the villages are studied. Results of the process are shown for four districts. Incoherencies and areas of improvement are assessed in the discussion. Policy inferences are given in the conclusions.

2. METHODOLOGY

Firstly, a brief history of decentralization in Tanzania is presented, together with the main institutional settings related to the water sector. Secondly, the general planning process is detailed. Thirdly, the key responsibilities of each government level (central government, district and village) regarding the allocation of resources in the RWSSP are studied.

Information about the program at national level was obtained through interviews with officials of the Ministry of Water, along with an extensive review of the unpublished and published documents from this Ministry and the Prime Ministers' Office. The analysis of the main decision makers at district level was based on field work conducted in four rural districts (Kigoma rural, Same, Iramba and Nzega) between July 2008 and August 2009. District councils were visited and interviews were held, particularly with district water engineers (DWEs) and district planning officers (DPLOs). For the purpose of understanding the drivers for resources allocation at lower levels of government, four wards were selected in two districts (Same and Nzega). They purpose was to include one ward with historically low investment in water supply and one with historically high investment in each of the districts. Interviews and group discussions were held with elected political representatives at ward, village and subvillage levels, as well as with government officers at village and ward levels. The village plans from the selected wards were examined and discussed with governmental and political local leaders.

3. DECENTRALIZATION IN TANZANIA

Local government was present in Tanzania even before independence. Its power eroded during the 1960s as a result of disagreements with elected councillors and a sharp reduction in income due to the abolition of certain local taxes (GoT, 2009). In 1972, a decentralization reform was implemented with a view to enhancing popular participation in development from the village level and heightening the role of the party. Local authorities were abolished (GoT, 1972). Village planning was introduced throughout the country (and is still implemented today) and social services rapidly increased. However, the quality of services remained poor, especially as regards water (Maro, 1990), and sectoral ministries became the direct service providers at local level. This period of centralization failed to deliver services and provide local democracy and governance, particularly in the areas of participation, transparency, and accountability (GoT, 2005). Local government was re-established in the 1980s but it had lost many of its experienced staff members and competencies. In addition, they were under-resourced, with central and sectoral ministries continuing to control finance, staff, and other resources. The current government's decentralization policy was outlined in the 1998 Policy Paper on Local Government Reform (GoT, 1998), which clearly sets out a policy of decentralization by devolution ('D-by-D'). Devolution refers to a transfer of competencies from the central to distinct legal entities, which should have wide autonomy. The policy is expected to reduce poverty by improving service delivery thanks to effective and autonomous local government authorities (LGAs).

One key aspect of decentralization in Tanzania has been the difficult relationship between LGAs and elected councillors. Ward councillors, and village and subvillage leaders are the political representatives at the decentralized level. People vote for their subvillage and village leaders in local elections; ward councillors are chosen in national elections. A ward typically comprises three to five villages, and a typical district has between 20 and 40 wards. Ward councillors are the main link between the population and the LGA administration. The most important decision-making space at LGA level is the full council meeting, which takes place at least four times per year and involves the heads of the LGA administration along with all district councillors. Councillors are highly influential due to the country's history of decentralization.

One of the most important aspects of decentralization in practical terms is the provision of funds that are channeled through transfers from central government to LGAs. Transfers in Tanzania are classified under block grants—intended to cover recurrent costs—and development grants. The system of allocating development grants was designed in the Local Government Support Project (LGSP), which provides for a transparent and performance-based system to assign development grants to LGAs. The project comprises three components, including the Support for Local Government Capital Development Grant System (LGCDG), which has been operational since the 2005/2006 financial year-going from July to June- and introduces two separate grant mechanisms (GoT, 2005): the Capacity Building Grant (CBG) and the Capital Development Grant (CDG). In order to qualify for the Capital Development Grant, LGAs must satisfy a number of minimum conditions (MCs). MCs are verified every year and concern LGA capacities with regard to: 1) financial management, 2) fiscal management, 3) planning and budgeting, 4) procurement, 5) the council's functional processes, and 6) project implementation, monitoring and evaluation capacity.

4. RURAL WATER SUPPLY AND SANITATION PROGRAM (RWSSP)

According to the latest national water policy (GoT, 2002), the central government plays the role of coordinator and facilitator in the water sector, while the district level holds the main implementation responsibilities. The approach to service delivery is the so called demand-responsive approach, DRA: communities should demand, own, and maintain their water services and participate in their design; full operation and maintenance costs are their responsibility, and they have to provide part of the capital costs through cash and kind (World Bank, 1998). The main policy implementation instrument is the Water Sector Development Program, whose rural component is the Rural Water Supply and Sanitation Program (RWSSP). The RWSSP, officially launched in 2006, establishes targets for the percentage of the population in rural areas with sustainable and equitable access to safe water: 1) 65% by 2010 (goal set by the National Strategy for Growth and Reduction of Poverty, MKUKUTA), 2) at least 74% by mid-2015 (MDGs), and 3) 90% by 2025. If these targets are to be met, water supply coverage will have to be extended to an additional 33.8 million people during the period 2005-2025. Estimated costs for the rural component (excluding small towns) are of 1,606 million US dollars (MUSD), with 1,465 MUSD for capital investment, 51 MUSD for management and operational support to districts and 17 MUSD for institutional strengthening and development (GoT, 2006).

Aligned with the policy, the key responsibilities identified for each government level regarding the allocation of resources in the rural water sector are presented in Table 6.1. These will be the aspects analyzed in this study for each governmental level.

Level of Government	Main responsibilities affecting allocation of resources
Ministry of Water	Design of the RWSSP Allocation of funds to districts Preparation of guidelines for implementation
District	Selection of targeted communities Preparation of District Water and Sanitation Plan Awareness and demand creation at community level
Village	Bottom-up annual village plan Application for RWSSP projects

Table 6.1. Main responsibilities at different government levels affecting the allocation of resources for the RWSSP.

5. GENERAL PLANNING PROCESS

The planning process at District level combines the bottom-up approach, starting at village level, with the top-bottom priorities established at upper levels. The allocation of funds and the processes involved are represented in Figure 6.1. Two main cycles are described: the Local Government Capital Development Grant (LGCDG) and the Rural Water Supply and Sanitation Program (RWSSP).

The evaluation of the Local Government Authority (LGA) performance during the previous year takes place in September in the framework of the LGCDG and is submitted to the Prime Minister’s Office (PMO-RALG). Around November, the ministry issues budget guidelines for the districts. These inform the wards and villages of the given financial and regulatory framework, including indicative planning figures (IPF). The priorities must then be developed at the lowest level with participatory planning methods such as Opportunities and Obstacles to Development (O&OD) and

Participatory Rural Appraisal (PRA). The results of these processes are included as priorities in the village plans, supervised in the Ward Development Committee (WDC), reviewed by the district and returned to the village assembly for approval. Every year, the budget, including the foreseen village plans, must be approved in a special public full council meeting by May 31. The LGA Director then submits the budget to PMO-RALG and the Ministry of Finance, and it is integrated into the national budget approved by Parliament in June. When the final budget is approved, the LGA informs the villages on the final availability of funds.

This participatory bottom-up process is currently linked only to the LGCDG. These consist on average of 1.5 USD per person per year, adjusted according to certain parameters (land in national parks and poverty) and by LGA performance. Fifty per cent of grant allocations are made at sub-district level (through village plans), while the other 50% are decided at LGA level (GoT, 2005). There is no specific procedure for allocating the remaining 50% of LGCDG money. This was confirmed in the districts studied, where funds were normally decided at Head of Department meetings, frequently guided by national directives. Hence, the indicative figures given to villages only apply for 50% of LGCDG funds. In practical terms, villages select one project per year, usually related to social service sectors. Typical projects include building classrooms or houses for teachers, minor rehabilitation of schools or dispensaries, and works on rural access roads. In general terms, LGCDG funds represented 32.74% of total development funds (including water) transferred to districts in 2007/2008 (GoT, 2008b).

The RWSSP uses the same system as the LGCDG and allocates development grants only to qualified districts. Out of 132 districts, only five failed to qualify for water development grants for the financial year 2009/2010. However, the mechanism is different. The ministry allocates funds to qualified districts according to formulae, and the LGA makes the final selection of beneficiary communities, discussed during the full council meeting. Villages are supposed to apply in advance, open a bank account, and deposit an initial contribution, which is the basis of the demand-responsive approach.

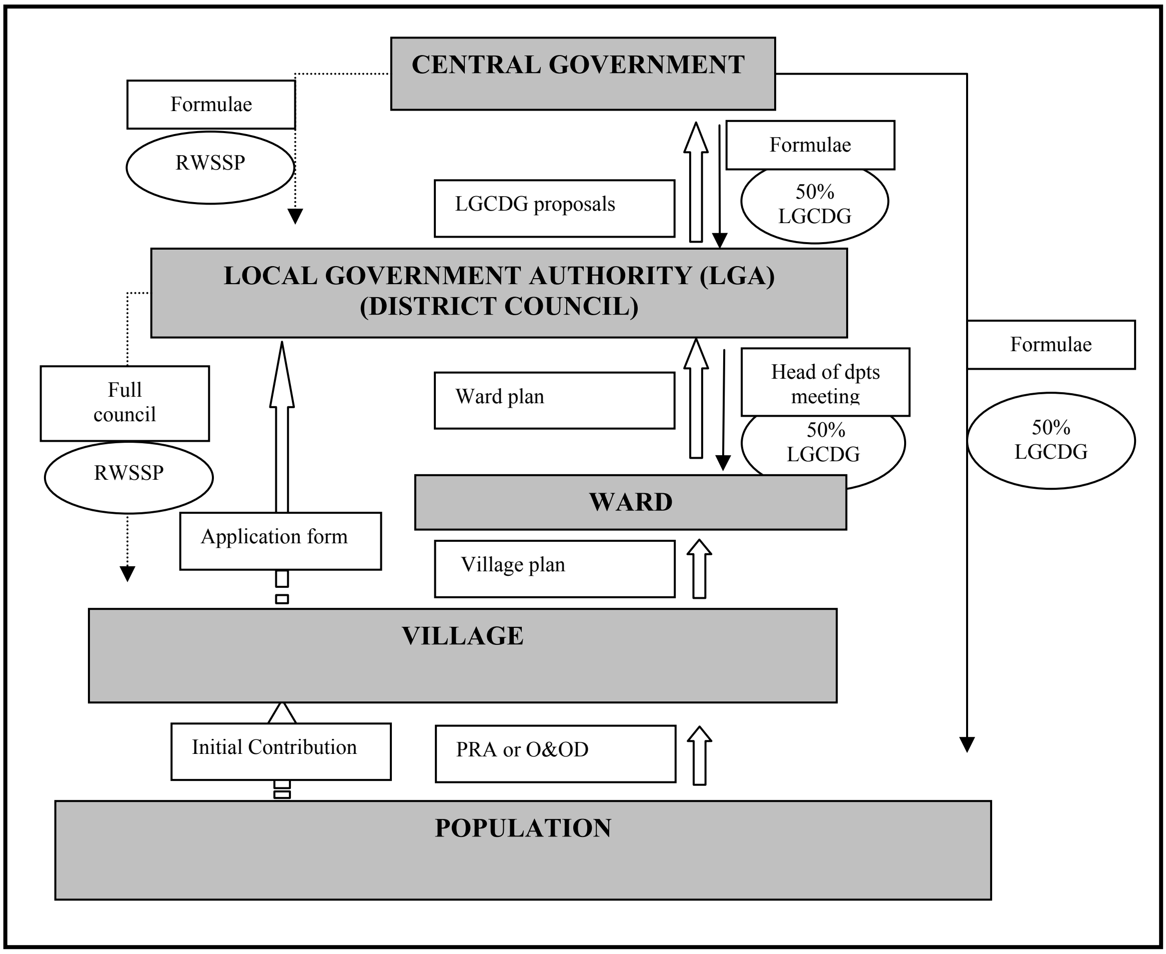

Figure 6.1. Mechanisms for allocating LGCDG and RWSSP funds

Note: Grey rectangles represent the different actors and levels of government involved. Circles represent the name of the funds allocated, and rectangles show the mechanisms to apply for or allocate those funds. Plain arrows show the local government funds (LGCDG). Discontinuous arrows show the water sector funds (RWSSP).

6. KEY ASPECTS AT MINISTRY LEVEL

The main responsibilities identified at ministry level that affect the allocation of RWSSP resources are: a) the design of the program, b) the allocation of resources for its implementation, and c) the formulation of guidelines to help LGAs implement the program (Table 6.1).

6.1.Design of the program

At the design stage, increasing equity was one of the underlying principles of the RWSSP (Giné and Pérez-Foguet, 2008). This principle was also highlighted in the National Water Sector Strategy, with a specific strategic statement related to the provision of services to low-income groups in peri-urban and rural areas (GoT, 2008c). At the design stage, the calculation of costs was based on two general principles:

- Districts with less coverage increase their level of service closer to the national level. In 2005, the reported coverage by district varied from 6.4% to 91.8%. The RWSSP targets that by 2025 all districts will reach the 80-95% range, with an average of 90%.
- Costs are calculated according to the technological options present in each district. Different combinations of technologies were estimated for every district, based on the current presence of technologies, combined with a demand assessment study and the opinion of experts.

Hence, the number of water points needed to attain the desired coverage for every district was calculated and the costs were assigned based on the foreseen technology mix. Ten different technology types were considered with their estimated per capita costs and average number of beneficiaries. This technology mix is in fact the main driver for cost calculation: neither the total costs per district nor the budget per capita have any relationship with the initial water coverage per district, as shown in Table 6.2. There is a slightly better but not still not representative relationship between the total cost and the total number of unserved people living in one district (R^2=0.40).

Variables confronted per District	Design phase	Implementation phase
Development budget vs. proportion of unserved population	$R^2 \approx 0$	R^2 =0.21
Development budget per capita vs. proportion of unserved population	R^2 = 0.10	$R^2 \approx 0$
Development budget vs. total number of unserved people	R^2 =0.40	R^2 =0.95

Table 6.2. R^2 of the linear correlation among selected variables at the design and implementation phase of the RWSSP.

6.2.Allocation of resources

A frequent problem of decentralization arises when one is designing allocation formulae, since they sometimes try to serve too many purposes, failing in their results (Shah, 1998). In practical terms, the allocation of RWSSP funds from ministry to district level is driven by formulae based on transparent criteria, which were introduced in 2005/2006.

Three different water budgets are in place: the Development Budget (also named the Capital Development Grant), the Recurrent Budget (also named the Rural Water Block Grant), and the Capacity Building Grant. Capital Development Grant funds can be used for implementing water infrastructures and constructing demonstration latrines. This represents 91.22% of the estimated budget of the program, as mentioned in section 4. The purpose of the Rural Water Block Grant is to provide recurrent funding for local water activities, including monitoring local access to potable water and implementing new local water schemes in unserved communities (GoT, 2006e); this budget was not included in the design of the RWSSP and depends on the transfers from the Prime Minister's Office. The Capacity Building Grant funds can be used to support the LGA in creation of capacities, although they also include the logistic support provided to districts through the program (rehabilitation of offices, purchase of vehicles, etc.).

The criteria for money allocation were described when the program was launched (GoT, 2006f). However, the implementation does not exactly correspond to the initially foreseen principles, as shown in Table 6.3.

Initially published criteria	Weight	Implemented criteria	Weight
Development budget (Capital Development Grant)			
Unserved population	70	Unserved population	70
Technology	30	Technology	30
Recurrent budget (Water Block Grant)			
Technology	55	Unserved population	90
Coverage	35	Equal shares	10
Poverty	10		
Capacity Development Grant			
Equal share to all districts		Equal share to all districts	

Table 6.3. Criteria initially published and currently implemented for allocation of funds.

Development budget. The criteria for allocating the development budget are similar between the program launch and implementation stages, but differ from the design stage. Technology and the total number of unserved population are used as the driving criteria (Table 6.2). The weight of technology differs from the initially published proposal (weight of 20% for gravity, 8% for pumping, and 2% for shallow wells) to the implemented proposal (13% for gravity, 11% for pumping, and 6% for shallow wells).This number shows the percentage of funds allocated for each group. Thus, the final funds allocated for one district depend on the number of districts in that group. As a result, the initial priority given by a greater weight to one group can be counterbalanced if it has a high number of districts. Allocation results for 2009/2010 confirm this aspect. Gravity systems receive less funding than pumping systems (coefficients of 0.00295 and 0.00355, respectively), despite the greater weight initially assigned to the gravity group (0.13 to 0.11). The application of the unserved population criterion also differs from the published methodology. Following initial plans, districts should be divided into three levels of service, giving a certain share of funds to each group. This would involve the same problem as the one described above for technology, but it is not being applied in the same manner. The proportion of unserved population living in one district compared with the total unserved population in the country is taken as the parameter for allocating funds. This represents a major shift between the intended goal and the implementation of the plan, since the largest groups of unserved people will be targeted, thus losing territorial equity. There is a good relationship between the overall number of unserved people living in a district and the money allocated to it (R^2=0.95, Table 6.2), but not between the money allocated and the coverage rate by district (R^2=0.21).

It is important to highlight that one of the challenges faced by the ministry regarding the implementation of the formulae is the reliability of the basic data given by districts. The population census was conducted in 2002; growth rates are applied uniformly by region, and thus inter-district variations are not considered. Moreover, the coverage data reported by districts are not always reliable. District water engineers recognize that data are not based on an extensive review of the situation, and this is confirmed by the difference found in some studies between the official coverage and the water point mapping studies for the same year (Jiménez and Pérez Foguet, 2009b). Inter-annual variability is also very high; for instance, from 2007 to 2008, 30 districts reported a coverage variation of at least 10% on the previous year. Of these, 16 reported a variation of over 20%, and seven reported one of over 30% (GoT, 2008).

Recurrent budget. In the recurrent budget, technology was initially foreseen as the main factor, with 55 percentage points distributed among the different categories of water points: pumping schemes would receive the primary attention (40), followed by gravity (10), and shallow wells (5). Coverage was also considered, with higher coverage being a reason to receive more funds. Poverty was also a factor, albeit a minor one. Current implementation differs greatly, with very high priority given to underserved areas (90%) and 10% allocated on the basis of equal shares, by which all urban and rural councils receive the same amount (GoT, 2007). Recurrent transfer allocations are affected as well by 'hold harmless' provisions, which ensure that no district receives less funding than the previous year (GoT, 2008d). The formula outcome is also adjusted to ensure that the increase of funds for a particular LGA does not exceed 25%. An excess of funds is partly distributed for holding the needy LGAs harmless (GoT, 2006g). According to the 2008/2009 ceilings for other charges (total recurrent budget minus personal emoluments) for the four districts studied, the allocated amount is between 4.2 and 8.4 euro cents per person per year, and the average for rural councils is 5.9 euro cents (GoT, 2008d). This is the investment assigned for the annual supervision, monitoring and support of water services in rural communities. The block grant also pays the recurrent costs of the urban water supply, when applicable. The Prime Minister's Office allows for exceptions when they are requested and adequately justified by the districts (GoT, 2007).

Capacity development grant. As regards the capacity development grant, the same amount is allocated regardless of the district. Predictions are that districts will receive yearly an average amount of 22MTZS (around 12500 euro) during the next three financial years (GoT, 2008).

6.3.Formulation of guidelines

The Water Sector Development Plan (WSDP) comprises a main document of 238 pages plus 19 annexes, 15 of them devoted to the Rural Water Supply and Sanitation Program (RWSSP). Altogether, they amount to over 1500 pages. As a result, information is repeated in several parts, and there are contradictions that lead to confusion in some aspects. Knowledge of the plan at LGA level is limited, and there is a lack of precise information on some key areas. This point analyzes the information given for two key aspects related to the allocation of resources at LGA level: 1) the appraisal of community applications, and 2) the preparation of the District Water and Sanitation Plans. The indications given in the annexes of the WSDP are summarized in Tables 6.4 and 6.5.

The selection criteria for appraisal of community projects are given for illustration and listed in various documents. The Project Operational Manual (GoT, 2006h) and the District Operational Manual (GoT, 2005b) name criteria to be adopted in terms of needs, but the existence of an account with money is stressed as a precondition for appraisal of the proposal. The Modular Training for District Water and Sanitation Team (GoT, 2006i) has specific handouts for weighting, ranking and prioritizing communities. Many sample criteria are proposed (18), with greater importance given to a community's needs and vulnerability than to demands expressed in cash. No indications are given regarding the relative importance of each criterion.

Reference document	Criteria (need)	Other criteria
Project Operational Manual (page 24)	Low coverage High incidence of diseases	Willingness and ability to pay Deposit in bank Efficiency
District Operational Manual (pages 4-1)	Water as a priority Vulnerability to diseases	Form Water Committee Raise commitment fee Open bank account
Modular training for DWST (page 35)	18 criteria given for illustration, focusing on accessibility, vulnerability to diseases and organizational capabilities of the community as applicable.	

Table 6.4. Criteria for appraisal of communities' applications expressed in the WSDP documents.

The District Water and Sanitation Plan (DWSP) is supposedly the district's key short- and medium-term planning document, but the RWSSP documents contain some contradictions when referring to it (Table 6.5). In the Project Operational Manual, the DWSP is a consolidation of the approved Facilities Management Plans, i.e., community sub-project proposals, and has a one-year duration. The same approach is repeated in the Guidelines for Operating District Water and Sanitation Grants. In the District Operational Manual, the DWSP is a detailed outline of what the district wants to achieve in terms of developing water supply and sanitation, and it should generate a three-year rolling district development plan as well as the first annual plan. It should also be developed on a collaborative basis with all stakeholders. Prioritization factors are suggested as indicative rather than in a weighted or ranked manner. Finally, the annex designed to train the District Water Sanitation Team provides examples of training strategies (starting with the most accessible areas, promoting demand in less served areas, promoting equity, etc.).

Reference document	Scope of the DWSP	Duration of the DWSP	Criteria given for inclusion in the DWSP
Project Operational Manual (page 25)	Community subproject proposals already approved	1 year	No
Guidelines for Operating District Water and Sanitation Grants (page 16)	Community subproject proposals already approved	1 year	No
District Operational Manual (pages 3-7)	Detailed outline of intentions of districts, with first year more detailed	3 years	Yes, indicative list. Not ranked
Modular Training for District Water Sanitation Teams (page 69)	Not given	Not given	No criteria. Examples

Table 6.5. Scope, duration and criteria for prioritizing communities given by the Ministry of Water for the formulation of the District Water and Sanitation Plan (DWSP).

7. KEY ASPECTS AT LGA LEVEL

As mentioned above, the RWSSP foresees that the LGA is the focal point for decentralized implementation, with a pivotal role to play in promoting demand at the community level, planning, providing support and monitoring the implementation of community projects (GoT, 2005b). The main activities influencing the allocation of resources at this level are the selection of communities, the elaboration of a District Water and Sanitation Plan, and the promotion of awareness and demand in the communities (Table 6.1), as analyzed below.

7.1. Selection of beneficiary communities

The selection of villages that will benefit from the first phase of the RWSSP was not rigorously recorded in any of the cases studied. The criteria that were found to be influential were as follows:

- The demand-responsive approach as a key policy principle. In practical terms, the demand is evaluated through the total cash contribution made by villagers and deposited in a bank account. Relative measures, such as contribution per capita, were not considered.

- Vulnerability to diseases and lack of access to water were named as criteria for assessing the need. However, comprehensive information by village or ward was not readily available in any of the districts, which made it difficult to apply the criteria in a rigorous way.
- The influence of both national and local level politicians; firstly, it was frequently stated that in the allocation of projects a balance had to be made between the constituencies of the district, represented by members of Parliament at the national level; secondly, ward councillors tried to play an influential role in the decision-making process. The selection of projects must be discussed with them at the full council meeting.

Additionally, the districts' technical staff reported a lack of tools and information for discussing the project allocation criteria with politicians. District Water Engineers (DWEs) argued that the total amount of funds in a bank account was a simple criterion for defending the choice of communities.

7.2. Ellaboration of a District Water and Sanitation Plan

None of the District Water Departments that were visited had a clear idea of the scope, duration, and criteria for making a District Water and Sanitation Plan (DWSP), or of their role in it. The DWSP will be outsourced to external contractors for the first phase of the RWSSP. The aim of the DWSP document is to guide the second phase of the RWSSP defining the priority villages of each district for the coming years.

7.3. Awareness creation at community level

Awareness creation regarding the procedures and mechanisms of the RWSSP was not undertaken regularly at community level in any of the districts studied. Only preselected villages were visited to obtain additional data and inform them about the procedures for completing the application forms.

In one of the four cases studied, an annual meeting was summoned in the district's main town to inform village and ward representatives about the RWSSP procedures. No follow-up of the effectiveness of those meetings was done.

8. KEY ACTIONS AT VILLAGE LEVEL

The development of an annual village plan and the completion of the stipulated application forms are the main actions implemented at village level that affect the allocation of resources for the RWSSP.

8.1. Annual village plan

Village leaders are largely familiar with the general planning process and respectful of the bottom-up approach. Village plans were prepared in all the villages visited. However, village leaders were not aware of any funding mechanisms other than their share of the Local Government Capital Development Grants (LGCDG). Village plans were drawn up considering only the available LGCDG budget, and village priorities were sometimes changed if they were too expensive for the available funds. For instance, one of the studied villages changed their priority from a water project to the building of a classroom because villagers were told that no funds were available for the initially selected priority. Village leaders also reported that their plans were influenced by national directives, including the construction of schools and dispensaries. Another case was found that confirmed this statement. The quality of the planning processes undertaken at village level was variable, in both methods and participation. They ranged from brief meetings with very little participation to full O&OD processes with external facilitators that last several days when the LGA had enough funds for it.

8.2. RWSSP application forms

We found little knowledge in the villages visited about the RWSSP selection procedures. Leaders felt that "wining" projects had to be done in the political arena, rather than through stipulated application forms. The opening of a bank account and specially the management of the initial contribution was seen as a difficult task to accomplish. Past experiences of misuse of funds were very frequently named and are behind people's reluctance to contribute. This is also confirmed by the evaluation of the pilot phase of the RWSSP; community initial contributions have been below the required amounts and embezzlement of funds is prevalent in the systems currently operating of the three districts studied (World Bank, 2008). Villagers were ill-informed of decision processes at district level. Minutes of full council meetings or notices regarding the RWSSP project selection were not found in any of the villages visited.

9. SELECTION OF PROJECTS FOR THE FIRST PHASE OF THE RWSSP

The analysis of the key processes affecting resources allocation was contrasted with the already selected projects for the first phase of the RWSSP in the fours districts studied. Results are discouraging (table 6.6). Out of the 40 projects (10 per district) allocated in the four districts studied, only 50% were allocated in wards with a coverage below the average of the corresponding district, and only 17 (42.50%) were in wards in the bottom half of the district coverage ranking. In aggregated terms, selected wards have 1.17 times better coverage than the average of their district, with extreme values of 1.65 and 0.81.

Name of district	Number of villages selected	Number of projects in wards in bottom half of coverage ranking	Number of projects in wards with coverage below district average	Ratio of average coverage of selected wards to district coverage
Iramba	10	50%	60%	0.81
Nzega	10	10%	40%	1.65
Kigoma	10	60%	60%	0.93
Same	10	50%	40%	1.29
AVERAGE	**10**	**42.50%**	**50%**	**1.17**

Table 6.6. Analysis of RWSSP-selected projects by ward compared with district coverage.

10. DISCUSSION

The analysis at various levels showed internal weaknesses and external limitations regarding the implementation of intended pro-poor policies at each level, as summarized in Table 6.7. External limitations result from solutions to weaknesses being beyond the capacities of a particular actor. Evidently, given that the different levels are interconnected, weaknesses at one level result in external limitations at other levels.

The overall objective of the program is to achieve an equitable increase in access so that all districts have between 80% and 95% of water coverage by 2025. Nevertheless, there have been important changes as regards the implementation of development fund allocations, which represent over 91% of total funds. The main driver of allocations in practical terms is the total number of unserved people living in a district, with a slight influence of technology. Thus, the main focus of the program has shifted from territorial equity to efficiency.

The water block grant (recurrent budget), intended to provide funds for recurrent costs, is allocated based on the unserved population living in a district. Support and supervision of community management and awareness creation should be regularly scheduled and common to all districts. This would be aligned with the intention of increasing equity at the sub-district level, as well as assisting communities to keep services operational. Thus, it is believed that the total population, combined with the size of the district, should determine the allocation of these funds. The level of functionality rates of water points could also be considered as a factor. Additionally, the amount of funds dedicated to these actions should be considerably increased from the current figure of around 6 euro cents per person per year. If no funds from PMO-RALG would be available, the use of own RWSSP funds should be considered, given the crucial importance of post-project support to sustainability and the important role of awareness creation for weaker communities to apply for a new project (Jiménez and Pérez-Foguet, 2010a).

The capacity building grant is allocated equally to all districts. Districts with lower coverage may require greater support during the initial steps of the program in order to secure future investments. Additionally, there is an urgent need to facilitate structured capacity building for all stakeholders to make a sound use of these funds. Some District Water Engineers reported that they face difficulties in spending the part of the grant of pure capacity building (around €3000 per district in 2009) in a sound manner. The development of the Strategic Framework for Capacity Development in the Water Sector in Tanzania (GoT, 2008e) is a first step that needs to be linked to budget and implemented down to a decentralized level.

There are no clear guidelines on the selection of communities or the elaboration of a District Water and Sanitation Plan at LGA level. Project selection criteria are loose and no indications are given on their relative importance. This has resulted in a narrow interpretation of the demand-driven approach (turned into "cash-driven") and poses the risk of facilitating political influences. In addition, the absence of reliable information on the situation at village level undermines the possibility of better resource allocation at all decision-making stages. In fact, district councils allocate projects based on a combination of need, demands (expressed in cash) and political influence. This tends to help bigger villages that are better connected and more influential, thus perpetuating existing inequalities. Moreover, this situation is not counterbalanced by regular awareness creation and facilitation in villages that are less organized or have worse connections. The dynamics of these districts are unlikely to be change in the short term from the bottom level. Village planning, which is well-established in the country, receives only a small fraction of development funds (32.74% in 2007/2008). The quality of planning processes varies among villages. Villages and councillors are not sufficiently aware of other funding mechanisms, and only preselected villages are being supported by the RWSSP to complete their applications and make initial contributions. In addition, villagers are ill-informed of application procedures and decision-making processes.

The DWSP may be an excellent opportunity to direct the RWSSP effort towards places in need. However, at present the risk of not taking this chance is high, as district officials do not have a clear picture of priorities and work has been outsourced to consultants without specific criteria and participation mechanisms to be followed everywhere.

Internal weaknesses	Level of government	External limitations
▪ Allocation of development funds maximizes number of beneficiaries, but not equity. ▪ Recurrent budget insufficient and poorly distributed. ▪ Capacity building budget is not giving additional support to weak districts, and there is a lack of a structured offer to use the funds. ▪ No clear guidelines have been drawn up for selection of communities or future planning.	MoW	▪ Recurrent budget is not considered in the design of the RWSSP and depends on the PMO-RALG. ▪ Lack of reliable source data at district level for allocating funds.
▪ Cash is taken as the key criterion for selecting communities. ▪ No regular data collected on the situation of water services at village level. ▪ Though awareness creation at village level forms part of the RWSSP project cycle, it is not seen as a priority.	District	▪ No guidelines available for prioritization of communities. ▪ Lack of tools to balance political influence. ▪ Not enough recurrent budget to undertake regular awareness activities.
▪ Lack of accountability and information given to villagers. ▪ Variable quality of village planning processes.	Village	▪ They procedures to apply for RWSSP projects are not known. ▪ Village plans are done considering only a part of the available funds. ▪ Sound management of initial contribution is a challenging task without facilitation and support.

Table 6.7. Summary of weaknesses for the improvement of resources allocation in the RWSSP.

11. CONCLUSIONS

Responsibilities regarding the delivery of social services have shifted many times in Tanzania over the course of its history. The success of policies may have as much to do with a coherent implementation of proposed institutional arrangements than with the model itself. The common condition of every institutional setup concerning water would be to respect the principle of a right to water, which involves the target of achieving the universal access and requires putting the procedures for non-exclusion, non-discrimination and participation in place. These principles are recognized by the Tanzanian government in several documents but they are not easy to implement. Main financing, allocation of funds, and responsibility for overall results of the Rural Water Supply and Sanitation Program (RWSSP) are at ministry level, while implementation relies on district authorities. Villagers are responsible for making the request and for co-designing, co-implementing and operating services. This institutional setup requires major top-down support to village level, which is not fully reflected in the design and implementation of the RWSSP.

The allocation of funds from the ministry level to the districts is quite transparent and follows reasonable criteria, but it is too focused on the development of new infrastructures, while recurrent budget remains far too small. The adequate channeling of funds encounters a number of obstacles at decentralized level, where the political influences and the lack of accountability tend to reproduce already existing inequalities. This effect is facilitated by some policy incoherencies and technical shortcomings in the implementation of the program, as it has been detailed. Hence, a bigger intervention of central level is required if the objectives are to be achieved. As regards resources allocation, the improvement of territorial equity at district level should become an explicit target of the program and be effectively included at all stages of its implementation. National directives could be given on a minimum level of service per ward and village, as occasionally occurs with other social services. This somehow undermines the decision of local authorities but may be effective as regards the ultimate goals of the program. The annual evaluation of the local government authorities is a powerful mechanism that could be used to include additional performance indicators and give incentives accordingly.

A much greater downwards accountability would be needed before benefits from decentralized decision-making can become true. This is a long process at the heart of the institutional and political culture of any country. Meanwhile central governments must ensure that the delivery of social services reaches the needed.

CHAPTER 7

Building the role of local government authorities towards the achievement of the human right to water in rural Tanzania.

ABSTRACT

In recent decades, many changes have occurred in the approach to financing and operating water services in developing countries. The demand-responsive approach is nowadays adopted in many countries in a context of donor-supported decentralization processes, which gives more responsibility to end users. However, the government's responsibility at different levels is enforced by the international recognition of the human right to water. This paper examines specific actions that build the role of local government authorities in this scenario. Results of the action research case study made in Tanzania from 2006 to 2009 are presented as representative of local capacity-building needs in decentralized contexts and rural areas. Three main challenges were detected: i) lack of reliable information, ii) poor allocation of resources in terms of equity, and iii) lack of long-term community management support from the district. Two mechanisms were established: i) water point mapping as a tool for information and planning, and ii) a District Water and Sanitation Unit Support (DWUS) to community management. The results show how the frame of human right to water helps to define useful strategies for equity-oriented planning and post-project support at the local level.

This chapter is based on

Jiménez, A., Pérez Foguet, A., (2010a). Building the role of local government authorities towards the achievement of the human right to water in rural Tanzania. *Natural Resources Forum*. In press.

1. INTRODUCTION

Water is indisputably the most politicized of public services, and developing countries have been greatly affected by the consequences of the ideological and political tendencies surrounding it, as it has been described in the Introduction. However, the recognition of the human right to water contained in General Comment 15 of the Committee on Economic, Social and Cultural Rights of 2002 is a key milestone in the debate, since it enforces clear obligations on governments to protect, respect, and fulfill this right. The obligation to fulfill is disaggregated into the obligations to facilitate, promote, and provide, which requires states to adopt the necessary measures to ensure the full realization of the right to water, "facilitating, inter alia, improved and sustainable access to water, particularly in rural and deprived urban areas" (UN, 2002; Kiefer and Brölmann, 2005). Moreover, a number of core obligations are identified with immediate effect in the General Comment, such as transparent planning, equitable distribution of resources, and monitoring. On the other hand, community service delivery is governed by the Demand Responsive Approach, as it has been described. This approach has generally been applied together with institutional decentralization processes. Theory says that the delegation of power to local governments will improve service delivery, decrease corruption, and increase public participation and the accountability of public officials (Steiner, 2007). However, decentralization outputs vary between countries. This problem is deepened in the rural water sector by the lack of reliable information systems capable of reflecting the reality of the situation at the grassroots level. At community level, the targeting problem remains (Galasso and Ravallion, 2005), while the poor are frequently less able to participate in those community processes that could eventually benefit them (Cleaver, 2005; Agrawal and Gupta, 2005; Hickey and Bracking, 2005). A more critical point of view relating to the characteristics of communities and their current limitations has emerged (Cleaver and Toner, 2006; Harvey and Reed, 2007; Bakker, 2008). Meanwhile, a very low level of sustainability of community rural supplies is found worldwide, especially in Africa (Harvey and Reed, 2004; RWSN, 2009).

Tanzania is a good example of these changing and sometimes contradictory processes. Table 7.1 shows the responsibilities related to water service provision, operation, and maintenance in recent decades, together with the progress achieved by the end of each period. The right to water is mentioned several times in the latest national water policy (GoT, 2002), and the corresponding water act (GoT, 2009b), according to which the central government plays the role of coordinator and facilitator, while the main implementation responsibility falls on the district council, the local government authority (LGA). Communities should demand, own, and maintain their water services and participate in their design. Full operation and maintenance costs are their responsibility, and they have to provide part of capital costs through cash and kind labour. Hence, we are dealing with a state that recognizes the right to water, has decentralized competences, and takes a fully demand-responsive approach to service delivery. The main policy implementation instrument is the Water Sector Development Program, whose rural component is the Rural Water Supply and Sanitation Program (RWSSP). Some of the challenges compromising the success of the RWSSP, which features ambitious targets for 2025 (Table 7.1), have already been highlighted:

- Poor targeting of underserved areas in the first phase of the program, despite the RWSSP's objective of raising coverage in all districts to values between 80% and 95%. A study of four districts conducted to assess the factors that affect the allocation of projects highlighted some weaknesses and showed that only 50% of projects targeted wards below the corresponding district average of access.
- Low sustainability of implemented rural supplies. A detailed study of three regions of central Tanzania shows that, depending on the type of water point (WP), 22% to 38% stopped working within five years and only 35% to 47% of WPs were working 15 years after installation (Jiménez and Pérez-Foguet, 2009c). Sustainability rates did not improve during the RWSSP pilot phase (2002-2008); the evaluation showed an average of 34% of non-functional WPs in recently finished infrastructures (World Bank, 2008).
- The lack of a reliable information system to monitor progress and inadequate institutional setup to learn from past mistakes (Giné and Pérez-Foguet, 2008).
- Sustainability is threatened by the limitations of community management of funds (World Bank, 2008), the establishment of intra-village pro-poor arrangements, and the difficult relationship between water user entities and elected village representatives (Cleaver and Toner, 2006).

This chapter builds on the role of LGAs in addressing these challenges and focuses on how to put into practice their responsibilities as duty bearers for the fulfillment of the human right to water. It draws on the results of collaboration between the international NGO Ingeniería Sin Fronteras (ISF) and the Same District Council (SDC) from 2006 to 2009 in the framework of an EU-funded program.

Firstly, background information about water point mapping (WPM) as an information tool is given. Secondly, the evolution of the district's water services from 2006 to 2009 is presented. The analysis leads to the definition of a new framework for improving the role of LGAs as regards resource allocation and long-term support to management, two of their key responsibilities for the fulfillment of the right. The conclusions draw on the relevance and replicability of this process.

Period and implementation arrangement	Target of coverage for rural areas	Roles and responsibilities	Coverage achieved in rural areas
1930-1970	No explicit target	▪ 75% financed by the central government and 25% by the LGA ▪ O&M paid by the LGA through taxes ▪ Passive role of the community	12% in 1971 (Tanzania Society, 1975)
1971-1990 Five-year development plans	100% coverage in 1990 (Nyerere, 1971)	▪ 100% financed by the central government ▪ O&M financed by the central government ▪ Community self-help initiatives for basic services	39% in 1990 (JMP, 2009)
1991-2001 Water policy 1991 (GoT, 1991)	100% coverage in 2002	▪ 100% financed by the central government ▪ O&M partially financed by end users (cost-sharing) ▪ Community only participates as regards O&M	44% in 2000 (JMP, 2009)

2002-2025 Water policy 2002 (GoT, 2002)	65% by 2010, 75% coverage by 2015, and more than 90% by 2025 (GoT, 2006)	▪ Approx. 90% financed by central government, 5% by LGA, and 5% by end users ▪ O&M by end users ▪ Community demands and fully participates in the design, implementation, and operation of services	46% in 2006 (JMP, 2009)

Table 7.1. Evolution of water provision roles in Tanzania

2. WATER POINT MAPPING IN TANZANIA

Water Point Mapping (WPM), as described in chapter 3, has been developed in Tanzania since 2005. So far, 51 districts out of 132 have been mapped, and the government plans to extend it to the whole country.

WPM calculates coverage through density, which is equal to the number of improved WPs per 1000 inhabitants (Stoupy and Sudgen 2003). In the case of Tanzania, a certain area is considered to have access if its density is four or more WPs per inhabitant (one WP per 250 people). The percentage of people who are not served in an area is proportional to the lack of WPs available compared with that threshold. Various indicators can be considered depending on the characteristics of the WPs assessed (Jiménez and Pérez-Foguet 2008). These range from the mere existence of WPs to the assessment of functionality and the seasonality and quality of the water delivered (Jiménez and Pérez-Foguet, 2009b). The possibilities are summarized in Table 7.2.

Despite the use of WPM as an information tool, its potential remains underexploited. A field study was carried out to assess the use of WPM in four districts where it had been in place since 2005 (Wateraid, 2009). The results showed that the incidence of WPM for better planning was still low despite the acknowledgment of its potential usefulness. The main constraints were related to the updating system and how it can be effectively included in the planning process. The work presented here shows a number of initiatives for overcoming these difficulties in the application of the tool.

Indicator	Calculation
Improved community WP density (ICWPD)	Number of improved community WPs (ICWPs) per 1000 inhabitants
Functional community WP density (FCWPD)	Number of functional ICWPs per 1000 inhabitants
Year-round functional community WP density (YRFWD)	Number of ICWPs working at least 11 months per year per 1000 inhabitants
Bacteriological acceptable WP density (BAWD)	Number of functional ICWPs with an acceptable number of coliforms at the time of the test per 1000 inhabitants
Bacteriological acceptable and year-round functional WP density (BA&YR-WD)	Number of ICWPs working at least 11 months per year and with an acceptable number of coliforms at the time of the test per 1000 inhabitants

Table 7.2. Indicators used by water point mapping

3. METHODOLOGY

The methodology was based on an extensive field study at district scale combined with interviews and meetings at village and ward levels. Working sessions and seminars were held with district officials to analyze results. An initial WPM study was conducted at the end of 2006 as a baseline on the state of water services in Same District, the results of which were presented on World Water Day 2007 to the Same District Council (SDC), stakeholders and the general population. The application of the tool was monitored with a focus on the coordination of stakeholders and decision-making regarding the water resource allocation of the SDC. In July 2009, a basic WPM update was carried out to assess its evolution from 2007 to 2009, which enabled a critical analysis of the investments made during the period, the programs planned up to 2011, and the general evolution of rural services. This process led to the definition of a framework for improving the LGA's planning and support to sustainability of water services and resulted in the setting up and approval of new institutional arrangements and priorities for water in Same District.

A joint working team was established by the district water department (DWD) and the NGO (ISF). Five people from the DWD, including the district water engineer (DWE), were involved at various stages of the process. A consultant was engaged for the WPM process in 2006. The 2009 update was carried out by a joint team comprising ISF and DWD members. The program coordinator and institutional development officer were the main actors from ISF. The researchers followed up the process with several stays in the area from 2005 to 2009. Volunteers were also involved in the gathering and processing of information.

4. THE EVOLUTION OF THE WATER SITUATION IN SAME DISTRICT

Same District is a rural district belonging to the Kilimanjaro region of northeast Tanzania. It has an area of 5,186 km^2 and a rural population of slightly more than 200,000 distributed in 24 wards, 82 villages and 445 subvillages, according to national census of 2002. Table 7.3 shows the comparative situation of Same District's water services between 2006 and 2009. During this time, 358 new WPs were constructed, which represents a 60% increase. The WP functionality rate was static at around 64%. Many of the new WPs were built in villages where the national coverage threshold was already met, since the proportion of redundant WP (those situated in villages already covered) rose from 22% to 33%, while Gini coefficient descended only from 0,62 to 0,59. Nevertheless, the number of villages without a WP dropped from 20 to 7 villages, and the number of subvillages with at least one functional WP has increased from 32% to 51%. This is an important factor in access analysis, given the scattered distribution of population in the villages.

This spatial distribution also determines that only a few multi-village systems exist in the District, and makes difficult the joint management of services in water trusts, which is a successful model implemented in nearby Districts (Cleaver and Toner, 2006).

Between 2006 and 2009 improvements were made to the coverage calculation. In 2006, the data were aggregated by ward, which concealed the inequalities between villages belonging to the same ward; in 2009 the calculation was done by village. These facts, combined with a population growth of 10,135, led to a rise in overall coverage from 43.37% to only 46.78%, despite the effort made to build new WPs.

The 2009 update compiled two additional aspects concerning the collection of regular WP tariffs and the existence of private connections. Only 27.45% of functional WPs collect regular tariffs. In aggregated terms, there is a regular tariff collection system in only 11 villages in the entire district (13%). There are private connections in 61% of the villages that have service, and 32 villages have more than 15. Some of these connections serve more than one family. In general, the uncontrolled connection to the network affects the functionality of community WPs and threatens the sustainability of the services. Only 13 villages with private connections declare that they collect some kind of payment for them, and it is a small yearly fee in almost all cases. If we presume that each private connection serves one household, around 11,606 people in Same receive this kind of service. Connections that were not reported to village leaders have not been considered.

PARAMETERS	Same 2006	Same 2009
Rural population	207800	217935
Number of total WP for human consumption	598	956
Percentage of functional WP	63.04%	64.02%
COVERAGE DATA		
ICWPD	65.06%*	68.76%
FICWPD	43.37%*	46.78%
BAFD	33.17%*	No data
YRFD	31.77%*	39.95%
BA&YR-FD	24.90%*	No data
EQUITY IN ACCESS DISTRIBUTION		
Gini coefficient calculated at village level	0,62	0,59
Percentage of functional WPs situated in villages already served	22%	33%
Number of villages without any improved WPs	20	7
Number of villages without any functional WPs	23	8
Number of subvillages with at least one functional WP	32%	51%
MANAGEMENT DATA		
Percentage of functional WPs collecting a tariff	No data	27.45%
Number of villages where none of the functional WPs collect a regular tariff	No data	63
Percentage of villages that have service and private connections	No data	61%
Number of villages with 15 or more private connections	No data	32

Table 7.3. Comparative table between basic indicators of water access in Same District (2006-2009)

**Note:* Coverage data in 2006 were calculated aggregated at ward level. In 2009, coverage was calculated by village.

4.1. Analysis of investments 2007-2009

The results of the evolution of water services were contrasted with the investments made. The only planning document for water services available in 2006 was based on the water shortage suffered in 2005 (SDC, 2006). Twenty-two rural villages were prioritized in the document based on the vulnerability to droughts.

In the financial years from July 2007 to June 2009, 47 actions involving provision and/or rehabilitation of water services were implemented in 35 villages. The first striking point is that nine villages benefited from more than one intervention, and there were cases of three interventions in one village and four in another. Meanwhile, 47 villages received no support. This can be partially justified by the fact that certain actions relating to the provision of WPs are far from complete, and therefore one village may not be completely served by one action. Twenty-three out of 46 villages with access below 25% were not targeted by any program. Eleven of the implemented actions (23.4%) were directed at villages above the average coverage.

The disaggregation of data by type of actor reveals who performed best (Table 7.4). The government appeared to perform very well in terms of allocation, but failed to direct NGOs to really underserved areas. There was also significant overlapping between the actions of the government and the NGOs, and between NGOs. Most of the projects implemented in the period by NGOs were designed before the first WPM campaign was conducted. The 2006 Water Shortage in Same District document had been the main planning tool. All of the villages where NGOs and other foundations had intervened were among the priorities detailed in that document.

4.2. Analysis of foreseen investments 2009-2011

In addition to the projects implemented until June 2009, the actions planned until 2011 were analysed. The main interventions for the period are the first phase of the RWSSP, which will provide access to 10 villages in the District, and two major programs by international NGOs. These actions were planned before the update of WPM information carried out in July 2009. Therefore, the WPM of 2006 was the best available tool on which to base the decisions and to compare the allocation of projects. The picture is now different, as illustrated in Table7.4. While NGOs have been able to adjust priorities according to the updated coverage data (88.89% of actions targeted villages with less than 25% coverage), the performance of the government has worsened. Only 61% of targeted villages have less than 25% coverage. This has a significant importance. The government projects allocated between 2007 and 2009 were the Quick Wins, which consisted of a small amount of money (around €20,000) for a short extension of service that can be decided directly by the District Water Department (DWD). The RWSSP provides full intervention in villages, with a significantly higher foreseen investment. Thus, the selection of villages had a greater relevance and received political influence. Out of the 10 villages selected for the RWSSP, two had already received projects in recent years.

It is important to underline that 19 out of the 22 villages prioritized in 2006 by the water shortage document will be targeted by a full coverage intervention in 2011. Only one of the three remaining villages has access below the district's average. By the end of the 2006-2011 five-year period, 69 interventions will have taken place in 46 villages. However, eight villages that did not have an improved WP in 2006 will not be targeted by any program, and 12 villages with less than 25% of coverage of improved functional WPs will also remain without support.

ACTIONS IMPLEMENTED 2007-2009				
Actor	Number of actions	Number of villages involved	% of targeted villages below average access	% of targeted villages below 25% access
Government	37	28	82.14%	71.43%
NGOs	10	8	62.50%	50.00%
TOTAL	**47**	**35**	**77.14%**	**65.71%**
FORESEEN ACTIONS 2009-2011				
Actor	Number of actions	Number of villages involved	% of targeted villages below average access	% of targeted villages below 25% access
Government	13	13	76.92%	61.54%
NGOs	9	8	88.89%	88.89%
TOTAL	**22**	**21**	**81.82%**	**72.73%**

Table 7.4. Summary of actions by actor

5. FRAMEWORK FOR THE IMPROVEMENT OF PLANNING

Analysis of the water situation conducted by researchers and the District Water Department (DWD) raised the following evidences:

- The water shortage document had been the most commonly used driver of planning for the major intervention programs. However, it was recognized that the priorities mentioned therein were not adequately justified. The WPM campaign showed that most of the villages were suffering low access (coverage in 18 of the 22 prioritized villages was lower than 25%), but seasonality of service was seriously affecting only three of them, despite being this the focus of the document.

- The understanding of the human right to water at District level was limited to the increase of coverage (construction of new water points). Hence, there was far more little attention paid to other aspects, such as quality of water served, affordability, participation and sound management, or principles of non-exclusion of some population groups.
- The DWD had made an important effort to allocate projects to underserved areas. However, this was mixed with the demand-driven approach, which was in fact "cash driven" given that the total amount of money in the bank account was used as the main factor for allocating projects. Additionally, political influence affected the selection of villages for the RWSSP, while the DWD lacked the tools to objectively defend their priorities. As a matter of fact, the same amount of RWSSP projects was allocated to each of the two constituencies of the district. Ward councilors were not sufficiently aware of the prescribed procedures for applying for water projects and were more dedicated to lobbying for support in their respective wards. The selection of projects and the criteria used were not adequately recorded.
- Village leaders and villagers had little information about their relative situation of access to water compared to neighboring villages, about the procedures to apply for water services, and, in general, about their rights and obligations regarding water. The most common perception at village level was that projects allocation is mainly a political decision taken at District level, sometimes influenced by the amount of cash contribution made by the community.
- Coordination of stakeholders was not successful. Different stakeholders (NGOs, private foundations and donors) come with their own timetables, budget limits, and logistics limitations. Hence, there are a number of actions that need to be planned, including the construction of new WPs, renovations, environmentally oriented actions, and places suitable for minor interventions. Frequently, only the need for full intervention was identified, which directed all actors to the same areas, resulting in overlapping actions.
- Since the WPM campaign conducted at the end of 2006, no regular information system had been in place in Same District to update the information on the existence

and functionality of WPs. The implementing partners were not giving enough information about the actions. The situation had significantly changed during this time as a result of the high number of interventions, but investments could not be reoriented accordingly.

This analysis led to the establishment of a framework for the improvement of planning. First, it was agreed that the district itself should take on a leading role and define priorities with a view to directing investments accordingly. This should be reflected in a document to be approved by the relevant organs and shared with political representatives and other concerned stakeholders. The agreed priority locations should be assisted in terms of awareness creation and facilitation of the initial steps of project application. During the implementation phase, there should be close supervision and coordination of incoming actors to avoid overlapping. Finally, a regular information system should be in place to direct investments according to the real situation. Figure 7.1 illustrates the simplified framework that was agreed. The main steps are described below.

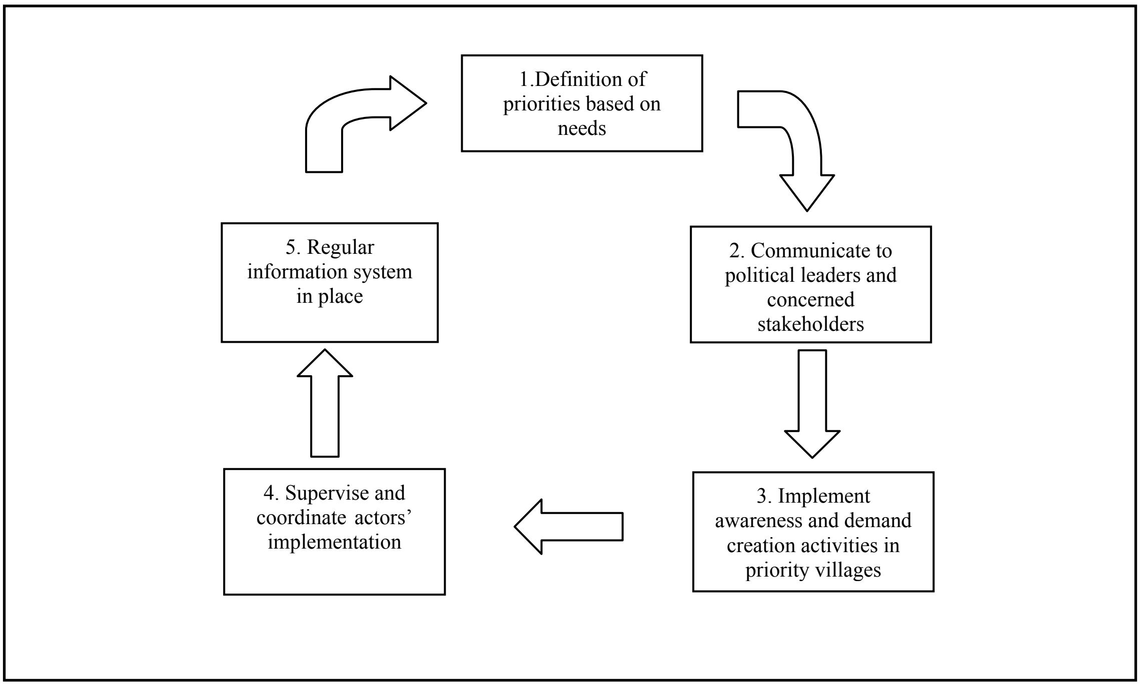

Figure 7.1. Framework for the improvement of planning.

5.1. Definition of priorities

One of the most important difficulties in adequately defining priorities has to do with the lack of systematized data available for all the villages of the district. WPM remedied this weakness with a minimum of bottom-up information. Additionally, WPM offers a great potential in terms of analysis and planning, but it remains underexploited. As a result, it was selected as the tool to define new priorities. Some simple indexes, organized in three groups, were defined to rank the priority of a variety of actions. They are summarized in Table 7.5.

The first group is formed by the indexes related to the increase of coverage, which includes the construction of new WPs (coverage index), the rehabilitation of non-functional points (rehabilitation index), and the construction of new WPs in underserved subvillages (intra-village equity index), which help to unmask inequalities at subvillage level that would otherwise be hidden. Same has a very scattered population distribution, and it can be presumed that subvillages without a WP are unserved according to the 400-m maximum distance set in the policy. Whenever two villages had the same index coverage, the biggest one was ranked first. This criterion does not maximize the number of beneficiaries. Hence, the objective is to achieve a minimal coverage of WPs per village across the entire district. This criterion increases the coverage at the lowest rates but promotes equity among villages. The assumption is that the highest vulnerability occurs in the absence of improved water sources: people in a "served" environment have easier access to some kind of improved service, even when the distance is longer and/or consumption is lower. This simple method was preferred to any combination of criteria (such as a mix of the proportion of unserved and number of beneficiaries) for two reasons; i) the territorial equity criteria targets universal coverage, which is aligned with the contents of human right to water; ii) it was considered important to have simple concepts that could be easily explained and discussed with politicians at ward and village levels, and simply understood by villagers.

The second group comprises indexes that affect the quality of the service. The seasonality index (SI) gives the proportion of functional WPs offering year-round service (at least eleven months per year) in a village. This index helps to spot environmental actions (particularly those related to source protection) and conflicts over use of the resource. The quality index (QI) shows the proportion of WPs that provide safe water compared with the functional ones.

The third group is formed by the indexes related to service management. The proportion of functional WPs that collect regular tariffs (pay per bucket or monthly payment) was taken as the key indicator for assessing management and led to the creation of the management index (MI). A low proportion of WPs paying a tariff would indicate a risky situation against any O&M requirement and therefore can be set as a priority for supporting community management. A private connection index (PCI) was also created to express the percentage of a village's population served by private connections. The assumption is that every private connection serves one average-sized household. This index aims to highlight the water user entities that should be specifically supported in the management of private connections, as they may otherwise threaten the sustainability of the service.

The ranking produced by every indicator was transposed into league tables, with priorities shown by type of action. Seven lists were created. Villages were prioritized when the threshold of the corresponding index was below 25%, except for the PCI, for which a value above 15% was taken as the threshold. This is represented in Table 7.5, together with the number of villages prioritized on each list. One village could not appear on more than one list of the first group (increase of service); evidently, the existence of WPs (CI) is the precondition for the other two indexes to be meaningful; the same village could appear on the two lists that deal with quality of service (SI, QI) as they each treat different aspects; and management is treated separately from the other groups.

It is acknowledged that some important aspects are not captured by the indexes defined. The tariff collected, compared to the level of service and financial capacity of each community can indeed leave people inside "served" villages without access to water. The same applies to discrimination by grounds of tribe or social exclusion in the community. Another important aspect that is not captured in this process is the level of satisfaction of the consumers with the provided service, and their feeling of ownership and participation in its management. These aspects have to be monitored and regulated by the District through the long term support to management described in section 6, since those aspects need a more intensive knowledge of each community concerned, which cannot be addressed in a WPM survey.

As a result of the process, the DWD was able to target different actions in different villages according to their specific situation (SDC,2009). The management of services and more specifically the establishment of tariff collection systems are now the biggest priorities at the district level..

The framing of the resource allocation decisions in terms of this group of indices oriented to tackle some important aspects of the content of the human right to water, will help to reduce the influence of local politics, through decision evaluation. Of course, local power relationships will continue to have influence despite this simple decision support tool, but this initiative clearly facilitates a desired development result, and enhances transparency.

Name of Index	Formula	Application	Threshold for prioritization	Number of prioritized villages
INDEXES RELATED TO THE INCREASE OF COVERAGE				
Coverage index (CI)	$CI= \frac{ICWP}{Village\ Population} x250$	Construction of new WPs	25% or less	8
Rehabilitation Index (RI)	$RI= \frac{FCWP}{Total\ ICWP} x100$	Rehabilitation of existing WPs	25% or less	6
Intra-village Equity Index	$EI= \frac{Subvillages\ with\ FCWP}{Total\ number\ of\ Subvillage} x100$	Construction and/or	25% or less	8
INDEXES RELATED TO THE QUALITY OF SERVICE				
Seasonality Index (SI)	$SI= \frac{Year\ Round\ FCWP}{Total\ FCWP} x100$	Actions to increase	25% or less	8
Quality Index (QI)	$QI= \frac{Good\ Quality\ FCWP}{Total\ FCWP} x100$	Actions to improve quality	25% or less	7
INDEXES RELATED TO THE MANAGEMENT OF THE SERVICE				
Management Index (MI)	$MI= \frac{FCWP\ with\ regular\ tariff}{Total\ FCWP} x100$	Management-supporting	25% or less	51
Private Connections	$PCI= \frac{Number\ of\ PC * Household\ size}{Village\ population} x100$	Support the establishment of	Above 15%	6

Table 7.5 Indexes based on WPM used for selecting priority villages for water-related interventions

5.2. Communication of priorities to concerned stakeholders

The discussion and approval of the priorities in the relevant district organs legitimated the criteria used. The establishment of an official LGA-owned priority document (SDC,2009) aims to reduce the political influence on resource allocation. In addition, communication to concerned stakeholders is deemed to increase the downward accountability of the LGA and facilitate coordination of non-governmental stakeholders.

5.3. Implement awareness creation in villages

To date, two meetings are held per year in the district capital to raise awareness among leaders of water project applications. Nevertheless, the effectiveness of these meetings is questionable, as confirmed by the knowledge level found during interviews at ward and village levels. The villages that are newly prioritized for full intervention will be specifically visited and supported in order to channel their needs into a demand and to help with the policy's application requirements. Thus, the demand creation will be included in the cycle and it will not be a pre-requisite that excludes less organized and remote communities.

5.4. Supervision and coordination of implementing actors

The national budget has already considered this activity, and a significant amount of money is being devoted in 2009/2010 to the field supervision of contractors during the first phase of the RWSSP. This is deemed crucial for the sustainability of the newly implemented services (World Bank, 2008) and must be complemented with regular stakeholder meetings. A greater engagement of non-governmental actors is required to effectively improve coordination.

5.5. Regular information system

The lack of a regular information system in districts has been recognized as a recurrent problem in rural areas (Wateraid, 2009). The DWD recognized that the figures submitted annually to the ministry are not based on an extensive review of the situation. Again, the potential of WPM should be considered, especially as it will be rolled out for the whole country. The methodology foreseen for updating the information did not initially involve a direct visit to the villages. It was based on the collaboration of the existing actors: i) information on newly installed WPs should be sent to the DWD by implementers; ii) status information on already installed WPs should be collected by government officers at village level once a year (village executive officers-VEOs); and iii) a full new WPM exercise should be conducted every four to five years. The methodology faced some constraints. Forty-seven interventions were recorded by the DWD in the period 2007-2009, but no detailed information was submitted by the implementers. Additionally, a pilot questionnaire was sent to six villages to test the efficiency of VEOs for updating, but it received a weak response in terms of quantity and quality of information.

These constraints highlighted the need to visit the villages in order to update the information. A simplified procedure was established to minimize costs. Rather than visiting each WP separately, the information was collected at village level. Village and sub-village leaders were summoned by letter to a meeting at the village office on a certain date, based on a timetable of visits that was established for the whole district. The situation of each WP was revised during the visits according to the existing database, and new WPs were recorded. This basic WPM update offered enough information summarized by village to complete the indexes described in Table 7.5. The exercise gave good results but it had some limitations. The position of new WPs was not recorded with GPS (although the name and location up to sub-village level is available), and quality tests were not carried out. During each visit, the DWD member gave village leaders some recommendations and inputs regarding the village's water status. Additional information was also collected that is not usually recorded in WPM, such as the number of sub-villages without functional WPs in every village and the estimated number of functional private connections.

This basic update is not intended to substitute a complete campaign every four to five years, but it does give a basic intermediate update on the situation. The implementation of routine information systems as initially foreseen is believed to be the procedure to work towards. Additionally, it is worth exploring the potential of mobile phones to provide updated information.

6. THE INSTITUTIONALIZATION OF POST-PROJECT SUPPORT

The analysis also underlined the alarming situation of community management and highlighted three main topics:

- Only 11 out of 82 villages collect regular tariffs, and 61% of villages have private connections. Bank accounts are rarely used, and the management of funds is not adequately controlled.
- Although the policy defines that the district is responsible for providing support to communities (GoT, 2005), there was no regular mechanism in place to support community-managed systems. Support was mostly based on emergency calls.
- Challenges affecting sustainability are wide and complex. Fund management is upfront, but a lack of technical capacities, land problems, and source unreliability are also frequent. Moreover, the overall hygiene and sanitation component remains weak and needs to be promoted in the long term.

These facts confirmed the need for sustained support to communities in order to keep services functional. Hence, the establishment of a district water and sanitation unit support (DWUS) was approved to specifically address these challenges. The expected outcome is an increase in the sustainability rates of the rural water and sanitation services in Same District, and the expected output is related to the establishment, legalization, and timely assistance to water user entities (SDC, 2009b).

Two main points were addressed regarding the DWUS:

i) A multisectoral team will be required to assist in different aspects. The team will be chaired by the district water engineer and have a secretary of the same department and another officer. A component of health, community development, education, finance, and planning departments will also be permanent members. A land officer, forest officer, and legal officer are occasional foreseen invitee members.

ii) The unit should be accountable to the district water and sanitation team formed by a water-related head of department who is responsible at LGA level for the implementation of the RWSSP.

The team will be in charge of continuous monitoring and support for the management of services, through regular visits to the communities and contact with WUE leaders, to detect and solve the conflicts that might arise, and to supervise key aspects such as transparency, affordability of the service and non-exclusion.

However, some challenges will need to be overcome.. The funds for recurrent costs at LGA level remain low, which makes it currently difficult to effectively support O&M at community level. Additionally, LGAs lack capable human resources in many departments, and daily coordination between departments remains a challenge.

Operational rules of DWUS have been developed, taking into account these limitations (SDC,2009c). Additionally, it is believed that the regular reporting and upward accountability of this unit, based on specific targets, can foster its efficacy. In this sense, the support to this initiative from higher levels of government is crucial for its success. Additionally, in order to be fully effective, this measure will need to be complemented by others already foreseen in the Water Sector Development Plan, such as the mechanisms for availability of spare parts in rural areas, and the capacity building of staff at District level.

Figure 7.2 shows the institutional arrangements for project and post-project implementation and the sectors that form the DWUS. The project implementation arrangement is already applied at the national level. Implementing partners have already been subcontracted in every district, and the DWD is responsible for their supervision. No specific setup has been defined for the post-project situation. The DWUS has been created with a view to filling this gap, which has also been recently highlighted in the pilot phase review (World Bank, 2008).

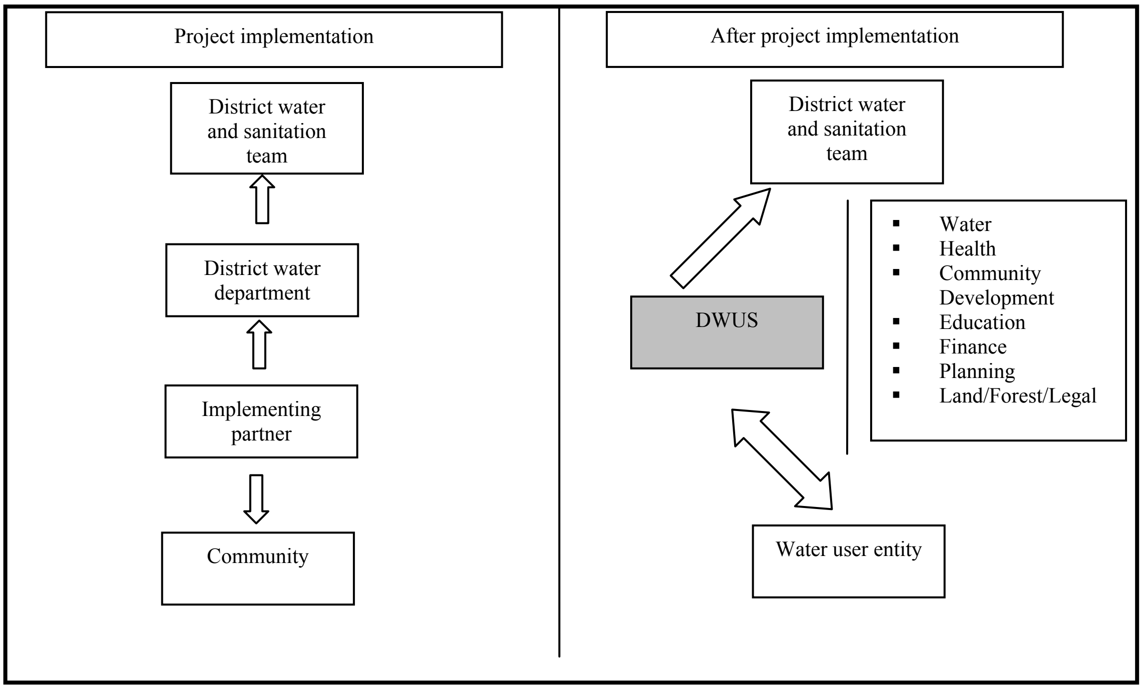

Figure 7.2. Institutional arrangements for project and post-project implementation of water services

Note: Rows show the direction of accountability; grey shows the new institutional arrangement.

7. CONCLUSIONS

The approach to the delivery of water in developing countries has shifted according to the successive predominant political and economic ideologies. Today, the recognition of the right to water is a milestone that requires governments to take on proactive roles in the provision and keeping of the service. Nevertheless, and despite being recognized in policy documents, the consequences of accepting the human right to water are not sufficiently considered in policy implementation. The main current concern is the rapid increase of coverage, while other aspects of the human right remain overlooked: universal coverage is denied against efficiency of the investments, quality of service is not controlled, and the principles of not exclusion by means of economical or social grounds are not sufficiently treated down to community level. Indeed, the approach to service delivery is marked by the demand-responsive approach and full operation and maintenance (O&M) borne on the community level, with results that are unequal and hardly sustainable. In this context, local government authorities (LGAs) are frequently trapped in a pitfall: clear targets of increased service and fulfillment of rights are proclaimed at the national level, but they are responsible for implementation (and are not always given enough resources). This paper has used a case study to address how LGAs can overcome some of these limitations and discusses pro-poor resource allocation, the creation of information routines, and long-term support to communities. .

The framework for the improvement of planning presented in this paper tackles some key points. First, LGAs must play a leading role if they are to be responsible for service provision. This was done by defining priorities based on objective data with a view to reducing the influence of politics. They were based on needs—territorial equity being the key driver—aligned with the target of universal coverage of such a right. Second, the inclusion of the demand creation by LGA's in the project cycle will prevent funds from being allocated only to the most prepared and organized villages and will focus on helping underserved communities to cope with the requirements. Third, the inclusion of a basic regular information system will help to monitor progress and ensure that resources are allocated according to the real situation. Framing the planning in terms of human right can definitely help to reduce local power influences, include the government support to weak communities and promote measures towards universal coverage. This would additionally require a wider acceptance of the contents of the human right at all levels of government, together with the definition of guidelines on how to address it into the daily governance of water services. Downwards accountability and awareness campaigns about the contents of right from the citizen point of view has to be also increased to allow for these changes in service delivery approach to be kept over time..

Long-term support to community management is an uncovered need for the rural sector in many countries and one of the key reasons for the low rates of sustainability that are observed worldwide. Thus, the establishment of a multidisciplinary and institutionalized organ to address this aspect is a step forward. However, there are challenges ahead related to the lack of funding from the central government, weak capacities, and department coordination.

The implementation of the human right to water is far from being embedded in the most common service delivery approach to rural water in developing countries. Despite being formally recognized, there is little done on how to deliver the right's contents to the citizens. Moreover, this challenge is greater in a process of decentralization, with lack of technical, human and financial resources at lower levels of government. While incoherencies in policies, institutional capacities and the service delivery approach remain unsolved, there remains a strong need to support understaffed and resource-limited LGAs and promote downward accountability. The process described herein is considered relevant given that the problems addressed affect many rural LGAs in developing countries in their capacity to effectively fulfill their responsibilities related to the human right to water, and it is replicable due to the simplicity of its tools and processes.

CHAPTER 8

Conclusions: challenges for water governance in rural water supply: lessons learnt from Tanzania

ABSTRACT

This chapter presents the summary and main conclusions of the research undertaken, as well as some indications for future research. These conclusions focus on the identification and analysis of key issues in the governance of rural water services in countries that suffer from a lack of access, high levels of poverty, administrative decentralization processes and significant donor support, such as Tanzania. A number of key weak points were identified at different administrative levels (local to national), such as the low quality of water services, their lack of sustainability, the difficulties of reaching the poor and insufficient internal information systems. The initiatives that were implemented to overcome the challenges are summarized briefly. Policy recommendations entail different paradigms for the provision of rural water supply: adoption of water supply as a service that is monitored and supported by the government, needs-based allocation of projects at community level, and improving guidance for local government decision-making are proposed.

This chapter is based on:

Jiménez, A., Pérez Foguet, A., (2010b). Challenges for water governance in rural water supply: lessons learnt from Tanzania. *International Journal of Water Resources Development*. In press.

1. INTRODUCTION

This research addressed some of the key issues that affect governance of rural water services in countries suffering from a lack of access and high levels of poverty, particularly in Sub-Saharan Africa. It focuses on mechanisms that can improve efficiency, equity and sustainability at national government level, as governments are considered the key duty bearers for the provision of this basic social service and human right. Tanzania was taken as a case study to address the relevant aspects. This country was analyzed in depth and compared with neighbouring countries. The method used combines quantitative data obtained from Water Point Mapping studies with qualitative data obtained through fieldwork, as well as an action research case study, which was carried out between 2006 and 2009. The main challenges of water governance that we found are described in Section 2. The initiatives that have been implemented to overcome those challenges are summarized in Section 3. The overall conclusions and future research lines are presented in Sections 4 and 5, respectively.

2. CHALLENGES FOR WATER GOVERNANCE IN RURAL AREAS

2.1 Low quality of delivered service

The aim of the Rural Water Supply and Sanitation Programme (RWSSP) is to provide safe and sustainable water services to the rural population. However, an in-depth analysis of current services shows that there are major threats to this target. The quality of water delivered and the reliability of the supply were analysed in a study covering 2,509 water points that serve 840,000 people in two districts (Jiménez and Pérez-Foguet, 2009b). The quality of water delivered was not satisfactory, due to coliforms in particular. When the information was disaggregated by category, about 40% of the ground water points were found to be polluted, together with 30% of gravity-fed systems. Seasonality also affected the services in up to 30% of cases, depending on the category and geographical location of the water point. In an analysis of the results by their corresponding networks, coverage was reduced by one quarter when the presence of coliforms was considered and by 20% to 33% with seasonality. When both quality and seasonality were combined, coverage figures for the districts were a factor of 0.57

and 0.55 lower than the figures that reflected functionality alone. The study shows that over 50% of functional, improved water points could be expected to have either quality or seasonality problems, which is in agreement with similar studies in the literature. For example, in an assessment of shallow wells in Guinea-Bissau (Bordalo and Savva-Bordalo, 2007), 79% of the 28 wells that were examined did not meet EU standards. Faecal contamination and low pH values were the main factors that affected quality. In a study carried out in Ethiopia that covered 70 parameters (Reimann et al., 2003), 78% of the 138 samples would not have passed EC water quality guidelines, with fluoride being the most conflictive parameter. Unpublished results from the Rapid Assessment Quality Water pilot test in Ethiopia were similar. Of the 290 boreholes tested, 23.10% had more than 10 CFU/100 ml, compared with 34.20% of the 155 protected dug wells and 46.70% of the 319 protected springs.

There are various explanations for these results. However, in the case studied, many of the problems were related to poor management of services rather than infrastructure failure or natural sources of pollution. As regards quality, contamination at source was predominantly due to bad management of water catchment. In a few cases, water was naturally polluted (salinity or fluoride). However, this aspect is increasingly controlled when new water points are created. Seasonality was related to depletion and bad use of sources due to i) inappropriate land uses around the source, ii) poor allocation to different uses of water abstracted from the same source, and iii) uncontrolled connections to the network, which produce shortages in the dry season.

This situation conflicts with the current scenario. On the one hand, quality monitoring and risk assessments are not part of national information routines. Moreover, the lack of capacity at community level to deal with the mix of environmental and social aspects that affect the quality and seasonality of the water consumed contrasts with the scant attention paid to conflicts about water use, capacity building and post-project support foreseen in the RWSSP.

2.2. Low sustainability

The RWSSP emphasizes the development of new schemes. It allocates less than 6% of investments to rehabilitation and less than 4% to district management support and capacity building. This allocation of resources is challenged by a study of current water point functionality-time relationships undertaken in a water point mapping survey that was conducted in three regions of Tanzania. Together, these regions account for 15% of the country's total rural population (Jiménez and Pérez-Foguet, 2009b). In this study, functionality and management-related water point mapping questions were disaggregated by technological category and administrative structure, and appropriate scales of analysis of the various relationships were justified. The functionality by category showed that only 45.3% of hand pumps, 48.6% of gravity-fed systems and 44.4% of motorized systems were functional at the time of the survey. Some WP categories were found to be quite sustainable in some areas and to fail completely in others. Nevertheless, the analysis showed a statistically significant relationship between functionality and category of WP at all administrative levels, including supra-regional, regional and, to a lesser extent, district levels.

Decreasing functionality rates over time were found for all WP categories. In aggregate terms, hand pumps had the least favourable functionality-time function, as they dropped from 61% in the first five years to 8% in the 30-year period. Motorized systems started at 79% and fell to 17% in the same period. Gravity-fed systems worked slightly better than any other category in the long run, as they dropped from 67% to 19%. In all three categories, just 35 to 47% of WPs were working fifteen years after installation, and 22 to 38% of them stopped working before five years. The latest data on the implementation of the pilot phase of the RWSSP (2002-2008) confirm the conclusions of this analysis (World Bank, 2008). Out of 197 water points examined in 19 sampled systems that were implemented in 6 districts over the last five years, 130 (66%) were functional at the time of the evaluation, with a 75% functionality rate for gravity-fed systems and 56% for hand pumps. These values show that the functionality-time tendency has not changed with the current implementation model.

RWSSP predictions estimated that 48% of people would be served by hand pumps, 25% by motorized systems and 21% by gravity-flow networks. Hence, the level of service provided and the technology proposed for the rural areas need to be reviewed, as the most predominant technology, the hand pump, is the least sustainable over time. It is true that community management requirements are lower for this technology than for any other. In turn, this might have led to the scant attention paid to building organizational capacities, which remain critical for maintenance. Moreover, it was expected that people would prefer the low-cost, low-service option. However, this is not the case, as the evaluation of the first phase of the RWSSP shows (World Bank, 2008). Sustainability is threatened by the limitations of community management of funds (World Bank, 2008), the difficult relationship between water user entities and elected village representatives (Cleaver and Toner, 2006), the low level of professionalism in the management of services (Giné and Pérez-Foguet, 2008), and the very limited role that decentralized government plays with regard to monitoring, regulation and technical support, among other factors. The policy and the RWSSP are vague in defining the setups that are possible at community level to manage the service effectively. The main responsibility is given to the community, but much greater support needs to be provided to attain effective, sustainable service management models.

2.3. Lack of pro-poor targeting

The allocation of funds at ministry level under RWSSP is a fairly transparent formula-based system. However, a thorough study reveals some drawbacks. i) It is too focused on the development of new infrastructures (91.2% of the programme's budget) and gives low priority to capacity building and post-project support. In fact, recurrent costs are not included in the programme's budget, and depend on transfers from the Ministry of Local Government (PMO-RALG). ii) It is focused on efficiency rather than on regional equity, despite the initial goal of raising coverage in all districts to over 80% by 2025. The main driver of fund allocation in practical terms is the total number of people with no water service in a district, with a minor influence of technology. In fact, the allocation data analyzed versus the population show that there is a good relationship between the overall number of people with no water service in a district and the money allocated (R^2=0.95), but not between the money allocated and the coverage rate by district (R^2 =0.21). iii) There are major differences between formula predictions and real allocations. Some regions get significantly more funds than the water formula would allow for, while in other regions the opposite holds true (World Bank, 2009).
Nevertheless, the greatest challenges for targeting the poor are found at district level. District councils allocate projects on the basis of a combination of need, demands (expressed in cash) and political influence. This tends to help bigger villages that are better connected and more influential. Thus, existing inequalities are perpetuated. The

situation is not counterbalanced by regular awareness creation and facilitation in villages that are less organized or have worse connections. The dynamics of these districts are unlikely to change in the short term from the bottom level. Village planning, which is well established in the country, receives only a small fraction of development funds (32.7% in 2007/2008) through local government grants (LGG). Villages and councillors are not sufficiently aware of programmes other than LGG, and only selected villages are being helped by the RWSSP to complete their applications and initial contributions. In addition, villagers are ill-informed of application procedures and decision-making processes. This mixture of policy incoherencies, technical shortcomings and political influence determines that only a small proportion of funds reach the underserved areas. A study that covered the 4 districts showed that, apart from the abovementioned facts, only 50% of the wards that were targeted in the first phase of RWSSP in these districts were below the corresponding district average of access. This is a common problem, as experience has shown that when governance is decentralized, local elite are frequently even less likely than the national elite to target government resources to the poor (Blair, 2000; Crook, 2003). Simultaneously, people's capacity to participate and hold local government accountable is reduced, especially for the poorest (Francis and James, 2003; Cleaver, 2005). Much greater vertical accountability would be needed before benefits from decentralized decision-making could be experienced. Meanwhile, central governments should ensure that the delivery of social services reaches those in need. This can be done by setting national minimum coverage standards per village, and giving incentives to districts with good pro-poor targeting.

2.4. Inadequate information systems

The failure to target the poor is also due to the lack of suitable and reliable information systems that show the status of water services across the region. This is a general concern for the sector, as demonstrated by the status of development of Sector Management Information Systems in the Sub-Saharan region (WSP, 2007). The case of Tanzania reflects the common challenges. Data published by the ministry, which are based on the coverage reported by districts, are not always reliable. District water engineers recognize that data are not based on an extensive review of the situation. Inter-annual variability is also very high. For instance, from 2007 to 2008, 30 districts reported a coverage variation of at least 10% on the previous year. Of these, 16 reported a variation of over 20%, and seven reported one of over 30% (GoT, 2008). This aspect has been identified before. It has been tackled by promoting Water Point Mapping, which has been supported by international NGOs since 2005. So far, 51 districts out of 132 have been mapped, and the government plans to extend this scheme to the entire country. This exercise has shown a much more reliable picture of the status of water inside the districts, and has highlighted major differences between official and onsite data, as well as significant internal inequalities. Despite the use of WPM as an information tool, its potential remains underexploited. A field study was carried out to assess the use of WPM in four districts in which it had been in place since 2005 (Wateraid, 2009). The results showed that the incidence of WPM for better planning was still low, despite the acknowledgment of its potential usefulness. The main constraints were related to the updating system and how it can be effectively included in the planning process. If the system is not updated, its usefulness will decrease every year.

3. INITIATIVES THAT HAVE BEEN IMPLEMENTED

Some initiatives have been tested and proposed to overcome the main challenges detected. These are described hereunder:

3.1 Promotion of Enhanced Water Point Mapping as an information tool

As it has been said, lack of reliable information is at the heart of some of the main problems of the sector. In this sense, Water Point Mapping (WPM) was created to overcome some of these difficulties and has been widely used in the country, but is facing the challenges for its updating as well as for the effective use of information. Two initiatives were tested:

- Implementation of a yearly basic update of WPM (Jiménez and Pérez-Foguet, 2010b**).** Currently, a typical district council does not have enough resources or capacities to repeat a whole WPM campaign every year. Consequently, a simplified procedure was tested in Same District, which reduced costs and the need of very qualified staff. Instead of visiting each water point, information was collected at village level through meetings with local leaders. Thus, information on all water points that had already been recorded in the initial WPM database was updated and completed with a list of new WP. This basic update of WPM gathers information about water points summarized by village. The position of new water points is not recorded with GPS, but the name and location of up to sub-village level is available, and maps can be produced. This basic update is not intended to substitute a whole campaign to be done every 4 to 5 years, but helps to develop a reliable information system at local level in the following aspects: i) it gives an updating option more adapted to the current resources and capacities of the districts; ii) it involves districts officials an local leaders in the collection of information; iii) it provides reliable information that can be used for planning at district level, as described hereinafter.

- Inclusion of basic quality testing and seasonality information in the WPM campaign. The Enhanced Water Point Mapping (EWPM) was piloted in two Districts (Jiménez and Pérez Foguet, 2009b), and as described above, unmasked important problems related both to quality and seasonality of the services. This facilitates the adoption of some corrective activities from the district level, as described hereinafter.

3.2. Link of Water Point Mapping results to District Planning

WPM offers great potential in terms of analysis and planning, but it remains underexploited to date. For the pilot action implemented together with the Same District Council, WPM was included in a wider framework for improving planning, which included three main actions: i) priorities based on objective data were defined using the results of the WPM update; ii) demand creation at community level has to be included in the LGA's activities, to prevent funds from being allocated only to the most prepared and organized villages; iii) information systems had to be regularly updated to feed the process, as described above. The aim of the process is that the LGAs focus on supporting underserved communities to cope with policy requirements and finally provides services where they are most needed. Priorities were defined on the basis of need, with regional equity as the key driver, in order to achieve universal coverage. For this purpose, some basic indexes were defined using the information obtained from WPM (Jiménez and Pérez-Foguet, 2010c). Planned actions included an increase of coverage (through new water points and rehabilitation), an increase of equity at village level (by targeting sub-villages with no access), improvement in the quality of water delivered and the implementation of environmental actions (particularly those related to source protection). Moreover, basic information on service management at village level helped to identify which villages must be more urgently supported to establish suitable management systems at community level. The output of the process was a district-owned planning based on need, rather than demand, as the main criterion (Same District Council, 2009), and included priorities for a wider range of activities, as defined above.

3.3. Establishment of district regular management support services

As described, low sustainability remains the greatest challenge in the Tanzanian rural water supply. This is a wide and complex issue that has various causes. Nevertheless, one of the main weaknesses is the absence of an institutional arrangement at district level to provide long-term support to community-managed water services. Community rural supplies need to be monitored and supported regularly by the appropriate level of government, the LGA in the Tanzanian case. However, some challenges will need to be overcome: i) the funds for recurrent costs at LGA level remain very low, which makes it difficult to effectively support O&M at community level; ii) the different aspects that threaten sustainability are above the capabilities of Water Departments alone; iii) LGAs lack human resources in many areas.

A proposal was developed together with Same District Council, named as the District Water and Sanitation Unit Support (DWUS). The DWUS has been designed as a multisectoral team comprised of members from nine departments: Water, Health, Education, Community Development, Finance, Planning, Forestry, Land, and Legal issues, in order to assist communities in the different challenges that may arise. The expected outcome is an increase in the sustainability rates of the rural water and sanitation services, through the establishment, legalization and support of water user entities (Same District Council, 2009b). The operational rules of DWUS have been developed taking into account the aforementioned current limitations of the LGAs.

4. POLICY IMPLICATIONS

This research explores possibilities to improve water-related services delivery in rural areas. Achieved results pointed out in previous section support the following policy recommendations:

- Sector information systems are more useful when i) data collection involves end users and promotes a thorough description of reality on the ground (through an adequate mix of survey instruments); ii) they produce outputs that are not only valuable for reporting to higher levels of government, but can also be used for decision making at intermediate levels; iii) the information is linked to territory, and thus it might be displayed via digital maps to facilitate interpretation and analysis; iv) updating can be done in the short term relying on available capacities at local level.
- The provision of improved water points is not enough to ensure safe drinking water quality. Thus, the inclusion of basic quality parameters and seasonality monitoring in the rural supplies is required to unmask important shortcomings in service provision, which might have undesirable effects on the well being of millions of rural users. Moreover, the expected costs for considering these aspects are relatively low: while costs for standard mapping range from 12-15 USD/WP, they raise up to 20 USD/WP when quality is included. In Tanzania, if enhanced water point mapping is applied to the entire country, total cost would roughly be 2 MUSD, compared to 950 MUSD of foreseen investment throughout the program for the period 2008-2012.
- The design of national water plans should include the necessary institutional arrangements and funds to provide LGA with adequate resources and capacities to supervise works and ensure post-project support to community water supplies. As a current constraint, this is particularly grave since it does not represent an important amount of funds when compared with investment for infrastructure, but with enormous consequences in the sustainability of services.
- The national plans have to ensure an adequate channelling of funds from the ministry level to the end users. In this aspect, increased decentralization of responsibilities can prevent funds from reaching the neediest, in those contexts

with weak democratic processes at local level. Hence some measures are proposed: i) equity in service provision at local level should become an explicit target to be monitored from central governments. National directives should be in place to guarantee a minimum level of service per ward and village, as it is done for other social services; ii) national plans should include in periodic evaluations some performance indicators related to equity and functionality rates at decentralized level, with incentives to well performing districts; iii) transparent mechanisms need to be developed to link monitoring information with decision-making at local level.

- National policies often state that community rural services have to be allocated through a demand responsive approach. An adequate interpretation of "demand" is far from easy. This has frequently been measured in terms of the amount in cash that a community is able to collect, which facilitates the influence of local political powers. Needs-based allocation of resources should be a must in rural water policies. Demand creation and facilitation should be effectively included in the project cycle, but not as a pre-requisite.

5. OVERALL CONCLUSIONS

The aim of this work was to study some of the key governance issues that affect the water sector in developing countries, especially in the rural areas of Sub-Saharan Africa. Tanzania was selected as case study. A comprehensive analysis of main challenges was undertaken, and some initiatives were piloted to improve policy-making towards better service delivery. The research, which addressed from national to village level, allowed some conclusions to be drawn.

Rural sector is dominated by important investment plans to increase access within more global strategies for poverty eradication. These usually occur together with a decentralization process. Service delivery in the rural context relies on a demand response approach at community level.

The overall performance is constrained by important weaknesses. Low quality and sustainability of the service, lack of pro-poor targeting and inadequate information systems were found to be the most significant challenges. Important changes in policy orientation need to be addressed to improve sector's performance. These involve the shift of some paradigms:

First, national policies and plans need to change from an infrastructure to a service approach. This implies that i) adequate resources should be envisaged for the operation and management of services in the medium term; ii) allocation of responsibilities for the management of the services has to be redefined. A greater balance between the participation of end users in the management of services and an adequate support and control from government institutions needs to be achieved. In this sense, the role of local governments has to be strengthened. They should effectively monitor and regulate the service, and provide technical support; iii) different possible setups (management by the community itself, outsourcing of some tasks to private service providers, total warranty schemes, etc.) have to be developed at community level to enable management of the service. The definition of an appropriate tariff structure that combines financial sustainability, demand management and access for the poor is a challenge that has to be faced.

Second and in terms of equity, project allocation decisions cannot be based on the demand of communities. Plans should be based on real needs, so that unorganized, poor, and small communities are not side-stepped from service delivery, and universal coverage can be achieved.

Third, decentralization is not beneficial for citizens per se. It is both a risk and an opportunity. Clearer orientations and incentives from central governments could be useful in the short term, together with the development of procedures to link available information to political decisions. Meanwhile, accountability to citizens and transparency has to be dramatically increased so that decentralization leads to better performance. On the other hand, the initiatives implemented in this research show that improvements can be easily tested and adopted at decentralized level and that is worth supporting these institutions.

Finally, the establishment of reliable and inclusive sector's information routines is the key ingredient for many of these changes to be possible, as well as to anticipate future challenges. Objective, reliable and detailed information about water access is essential. Tools based on GIS, like the Water Point Mapping, have great potential. But above all, the will of having reliable monitoring systems in the water sector should become a real priority for international donors and governments.

6. FUTURE RESEARCH

This work paved the way for future research in water governance:

- Suitable service delivery and management models for rural water supply need to be further studied. Finding the right arrangement of responsibilities in rural water is a great challenge, considering the obligations of the State in terms of the human right to water. The balance between the participation of end users in the management of services and adequate support and control from government institutions needs to be further developed.
- The link between information (indicators) and political decision making is far from automatic. Adequate institutional arrangements need to be further studied to allow objective information to effectively drive decisions, and to reduce the arbitrary influence of politics. Moreover, multi-actor decision support systems that are adapted to the context can be very valuable.
- Pro-poor targeting mechanisms have to be further developed at all levels (including community) if we want increased amounts of funds to result in more equitable access to services. This has to be complemented with adequate participation processes that allow the poor to make their voice heard.
- How tariffs should be established and collected under different social, economic, political, and institutional conditions is as well a priority research item for the future.
- Mechanisms and incentives to improve accountability at all levels have to be further developed, based on experiences and lessons learnt. In this context, new information and communication technologies can provide interesting input on how to develop these mechanisms.

It is widely admitted that access to safe water and sanitation is a pre-condition to escape from poverty. However, it can also be a means to fight it. Wider knowledge is needed about the social and economic processes around water and its management, so that access to it can give additional impetus to societies in the daily fight against poverty.

REFERENCES

Agrawal, A., Gupta, K., (2005). Decentralization and Participation: The Governance of Common Pool Resources in Nepal's Terai. *World Development*, 33 (7): 1101–1114.

Ahmad , J., Goldar ,B., Misra, S., (2005). Value of arsenic-free drinking water to rural households in Bangladesh. *Journal of Environmental Management* 74, 173–185.

Allesina, A., Dollar, D., (2000). Who gives foreign aid to whom and why?. *Journal of Economic Growth* 5; 33-63.

Bakker, K., (2007). The "Commons" Versus the "Commodity": Alter-globalization, Anti-privatization and the Human Right toWater in the Global South. *Antipode*, 39 (3): 430-455.

Bakker, K., (2008.). The ambiguity of Community: Debating alternatives to private-sectorprovision of urban water supply. *Water Alternatives*, 1(2):236-252.

Barlow, M., (2001). Commodification of water – the wrong prescription. *Water Science and Technology*, 43 (4): 79–84.

Barlow, M., (2009). *Our water commons: towards a new freshwater narrative*. Available at http://www.canadians.org/water/publications/water%20commons/index.html [accessed January 2010].

Baulch, B., (2006). Aid Distribution and the MDGs. *World Development,* 34 (6): 933–950.

Berthelemy, J.C., Tichit, A., (2002). *Bilateral Donors' aid allocation decisions: discussion paper 2002/123*. World Institute for Development Economics Research.

Birdsall, N.,(2004) *Seven Deadly Sins: reflections on donors failings*. Working paper 50, Centre for Global Development, Washington D.C.

Biswas, A.K., (2001). Water Policies in the Developing World. *International Journal of Water Resources Development*, 17 (4): 489–499.

Biswas, A.K.,(2005). An Assessment of Future Global Water Issues. *International Journal of Water Resources Development* 21 (2): 229–237.

Biswas, A.K., (2007). Water as a human right in the MENA region: challenges and opportunities. *International Journal of Water Resources Development*, 23(2): 209-225.

Biswas, A.K., (2008). Integrated Water Resources Management: Is It working?.. *International Journal of Water Resources Development*, 24 (1): 5–22.

Biswas, A.K., Seetharam, K.E., (2008). Achieving Water Security for Asia. *International Journal of Water Resources Development*, 24 (1): 145–176.

Blaikie, P., (2006). Is small really beautiful? Community-based natural resource management in Malawi and Botswana. *World Development* 34(11): 1942–1957.

Blair, H., (2000). Participation and Accountability at the Periphery: Democratic Local Governance in Six Countries. *World Development*, 28 (1): 21–39.

Bordalo, A.A, Savva-Bordalo, J., (2007). The quest for safe drinking water: an example from Guinea-Bissau (West Africa). *Water Research* 41: 2978-2986.

Briscoe, J., (1999). The financing of hydropower, irrigation, and water supply infrastructure in developing countries. *International Journal of Water Resources Development*, 15 (4): 459-491.

Camdessus, M., (2003). *Financing Water for All*. Report of the World Panel on Financing Water Infrastructure. 3rd World Water Forum. 16-23 March 2003, Kyoto.

Carter, R., Tyrre, S.F., Howsam, P., (1993). Lessons Learned from the UN Water Decade. *Water and Environment Journal* , 7 (6): 646–650.

Chaves, H.M.L., Alipaz, S., (2007). An Integrated Indicator Based on Basin Hydrology, Environment, Life, and Policy: The Watershed Sustainability Index. *International Journal of Water Resources Development*, 21 (5): 883-895.

Cleaver, F., (2005). The inequality of social capital and the reproduction of chronic poverty. *World Development*, 33 (6): 893–906.

Cleaver, F., Toner, A., (2006). The evolution of community water governance in Uchira, Tanzania: The implications for equality of access, sustainability and effectiveness. *Natural Resources Forum,* 30, *207–218.*

Cortes-Maramba , N., Reyes ,J.P., Francisco-Rivera, A.T., Akagi ,H., Sunio ,R., Panganiban, L.C., (2006). Health and environmental assessment of mercury exposure in a gold mining community in Western Mindanao, Philippines. *Journal of Environmental Management* 81: 126–134.

Crook, R., (2003). Decentralisation and poverty reduction in Africa: the politics of local–central relations. *Public Administration and Development*, 23: 77–88.

Cullis, J., O'Reagan, D.P., (2004). Targeting the water-poor through water poverty mapping. *Water Policy*, 6: 397–411.

de Rienzo, P., (2006). Aid, Budgets and Accountability: A Survey Article. *Development Policy Review*, 24 (6): 627–645.

Development Assistance Committee (1978). Recommendation on Terms and Conditions of Aid. *Reporting Directives for the Creditor Reporting System*, publication number DCD/DAC(2002)21, Development Assistance Committee, Directorate for Co-operation and Development, OECD.

Development Assistance Committee (1987). DAC Guiding Principles for Associated Financing and Tied and Partially Untied Official Development Assistance. *Reporting Directives for the Creditor Reporting System*, publication number DCD/DAC(2002)21, Development Assistance Committee, Directorate for Co-operation and Development, OECD.

Development Assistance Committee (1992). New Measures in the Field of Tied Aid. Development Assistance Committee. *Reporting Directives for the Creditor Reporting System*, publication number DCD/DAC(2002)21, Development Assistance Committee, Directorate for Co-operation and Development, OECD.

Development Assistance Committee (2000). *DAC statistical reporting directives*, publication number OECD/DAC(2000)10, Development Assistance Committee, Directorate for Co-operation and Development, OECD.

Development Assistance Committee (2002). *DAC guidelines on poverty reduction*, publication number DCD/CAD(2001)3/FINAL, Development Assistance Committee, Directorate for Co-operation and Development, OECD.

Development Partners Group Tanzania, (2009). Information available at http://www.tzdpg.or.tz/external/dpg-tanzania/overview-of-aid-in-tanzania.html. [accessed January 2010]

Ellis, F., Mdoe, N., (2003). Livelihoods and rural poverty reduction in Tanzania. *World Development*, 31 (8): 1367–1384.

European Union (2006). *European Consensus on Development*. Official Journal of European Union, 24.02.2006.

Faguet, J.P. (2004). Does decentralization increase government responsiveness to local needs? Evidence from Bolivia. *Journal of Public Economics* 88, 867– 893.

FAO (2003). Review of World Water Resources by Country. Water Report 23. Database available at http://www.fao.org/AG/AGL/aglw/aquastat/main/index.stm [accessed January 2010].

Fay, M., Leipziger, D.,Wodon, Q.,Yepes, T., (2005). Achieving Child-Health-Related Millennium Development Goals: The Role of Infrastructure. *World Development* 33(8): 1267–1284.

Fewtrell, L., Kaufmann, R. B., Kay, D., Enanoria, W., Haller, L., Colford, J.M., (2005). Water, sanitation, and hygiene interventions to reduce diarrhoea in less developed countries: A systematic review and meta-analysis. *Lancet Infection Disease* 5 (1): 42–52.

Ford, J. (1999). Rationale for decentralization. In Jennie Litvack and Jessica Seddon (Eds) *Decentralization briefing notes*, 6-8. World Bank Institute, Washington, DC.

Francis, P., James, R., (2003). Balancing rural poverty reduction and citizen participation: The contradictions of Uganda's decentralization program. *World Development* , 31 (2): 325–337.

Franks, T., Cleaver, F. (2007).Water governance and poverty: a framework for analysis. *Progress in Development Studies;* 7; 291.

Galasso, E., Ravallion, M., (2005). Decentralized targeting of an antipoverty program. *Journal of Public Economics*, 89: 705–727.

Giné, R., Pérez-Foguet A. ,(2008). Sustainability assessment of national rural water supply program in Tanzania. *Natural Resources Forum*, 32, 327-342.

Global Water Partnership (2000). *Towards Water Security: A Framework for Action*. Presented at the 2nd World Water Forum, La Hague, 2000.

Godfrey, S., Kizito, F., Howard, G., (2003). Statics Risk mapping using a Geogaphical Information System. *Proceedings of the 29th WEDC International Conference.*

Godfrey, S., Freitas, M., Muianga, A., Amaro, P., Fernandez, P., Sousa Mosies L., (2009). Sustainability check, a monitoring tool for the sustainability of rural water supplies. *Proceedings of the 34th WEDC International Conference*.

Government of the Federal Democratic Republic of Ethopia (1999). *Ethiopian Water Resources Management Policy*. Ministry of Water Resources. Addis Ababa, Ethiopia.

Government of the Federal Democratic Republic of Ethiopia, (2008). *Ethiopia Water Supply, Sanitation and Hygiene Monitoring and Evaluation Framework and Manual*. Version 1.0. Addis Ababa.

Government of Ghana (2008). *National Water policy*. Ghanaian Water Resources Commission, Accra.

Government of Mozambique (1995). *Politica Nacional de Aguas*. Boletim da Republica. August, 23th, 1995.

Government of the Republic of Uganda (1999). *National Water Policy*. Directorate of Water Development, Kampala.

Government of United Republic of Tanzania (1972). *The decentralisation of government administration (interim provisions) Act*, no 27, 1st July 1972.

Government of United Republic of Tanzania (1991). *National Water Policy*. Ministry of Water, Dar es Salaam.

Government of United Republic of Tanzania (1998). *Local Government Reform Programme – Policy Paper on Local Government Reform*,. Ministry of Regional Administration and Local Government, P.O. Box 1923 Dodoma, October 1998.

Government of United Republic of Tanzania (2002). *National Water Policy*. Ministry of Water and Livestock Development. Dar es Salaam.

Government of United Republic of Tanzania (2005). *LGCDG System Implementation and Operations Guide***.** July 2005.

Government of United Republic of Tanzania (2005b). *Water Sector Development Program. Annex6: District Operational Manual*. Ministry of Water, September 2005.

Government of United Republic of Tanzania (2006*). National Rural Water Supply and Sanitation Programme. Report and Main annexes*. Ministry of Water, January 2006.

Government of United Republic of Tanzania (2006b). *Water Sector Development Program. Implementation Manual, Annex 4: Formula Based allocation of financial resources to local government authorities*. Ministry of Water, January 2006.

Government of Tanzania (2006c). *Water Sector Development Program 2006-2025*. Ministry of Water, November 2006. Page 5-4.

Government of Tanzania (2006d). *National Rural Water Supply and sanitation Programme. Report and Main annexes*. Ministry of Water, January 2006. Annex B-Appendix 4.

Government of United Republic of Tanzania (2006e).*Guidelines for the preparation of local government authorities' medium term plans and budgets for 2006/07 to 2008/09*. Prime Minister's Office Regional Administration and Local Government (PMO-RALG) P.O. Box 1923 Dodoma, March 2006.

Government of United Republic of Tanzania (2006f)**.** *Local Government authority development planning and strategic planning participants' handbook*. Prime Minister's Office Regional Administration and Local Government (PMO-RALG) P.O. Box 1923 Dodoma, March 2006. Page 26.

Government of United Republic of Tanzania (2006g). *Water Sector Development Program. Implementation Manual, Annex 3: Guidelines for Planning and Operating District Water and Sanitation Grants*. Ministry of Water, February 2006. Part IV, page 33.

Government of United Republic of Tanzania (2006h). *Water Sector Development Program. Annex 5: Project Operational Manual*. Ministry of Water, February 2006.

Government of United Republic of Tanzania (2006i). *Water Sector Development Program. Annex 7: Modular Guide for DWST Training*. Ministry of Water, March 2006.

Government of United Republic of Tanzania (2007). *Guidelines for the preparation of local government authorities' medium term plans and budgets for 2007/08 to 2009/10*. Prime Minister's Office Regional Administration and Local Government (PMO-RALG) P.O. Box 1923 Dodoma. March, 2007 **.**

Government of United Republic of Tanzania, (2008). *Water Sector Performance Report for the year 2007/2008*. Ministry of Water and Irrigation. October 2008. Page 81.

Government of United Republic of Tanzania (2008b).*Guidelines for the preparation of local government authorities' medium term plans and budgets for 2008/09 to 2010/11 volume I*. Prime Minister's Office Regional Administration and Local Government (PMO-RALG) P.O. Box 1923 Dodoma, April 2008. Page 44, table 5.1.

Government of United Republic of Tanzania (2008c). *National Water Sector Development Strategy*. Ministry of Water. September 2008. Page 7.

Government of United Republic of Tanzania (2008d).*Guidelines for the preparation of local government authorities' medium term plans and budgets for 2008/09 to 2010/11 volume I*. Prime Minister's Office Regional Administration and Local Government (PMO-RALG) P.O. Box 1923 Dodoma, April 2008.

Government of United Republic of Tanzania (2008e). *Strategic Framework for capacity Development in the Water Sector in Tanzania*. Water Sector Working Group. Thematic Working Group on Institutional Development and Capacity Building. August 2008.

Government of United Republic of Tanzania (2009). *Local Government Reform Programme***.** Accesible at http://www.pmoralg.go.tz/lgrp/index.php**.** [accessed January 2010]

Government of United Republic of Tanzania (2009b). *The Water Supply and Sanitation Act*, No 12, 15th May 2009.

Gupta, S., Pattillo, C., Wagh, S. (2006). *Are Donor Countries giving more or less Aid?*. International Monetary Fund, Working Paper 06/01.

Gurría, A., (2007). Guest Editorial: Water- A Global Challenge and a Priority for the OECD. *International Journal of Water Resources Development*, 23 (4): 563–570.

Hall, D., Lobina, E., (2004). Private and public interests in water and energy. *Natural Resources Forum,* 28: 268–277.

Harvey, P., Reed, O., (2004). *Rural water supply in Africa: building blocks for handpump sustainability.* WEDC, Loughborough University, UK. Page 5-6.

Harvey, P. (2007). Cost determination and sustainable financing for rural water services in sub-Saharan Africa. *Water Policy,* 9, 373–391.

Harvey, P., Reed, R.A., (2007). Community-managed water supplies in Africa: sustainable or dispensable?. *Community Development Journal*, 42 (3): 365-378.

Heidecke, C., (2006). Development and evaluation of a regional water poverty index for Benin. *EPT Discussion Paper 145*. Environment and Production Technology Division. International Food Policy Research Institute. Washington, USA.

Hickey, S., Bracking, S., (2005). Exploring the politics of chronic poverty: From representation to a politics of justice?. *World Development*, 33(6): 851–865.

Hoko, Z., (2005). An assessment of the water quality of drinking water in rural districts in Zimbabwe: the case of Gokwe South, Nkayi, Lupane, and Mwenezi districts. *Physics and Chemistry of the Earth,* 30: 859-866.

Hoko, Z., Hertle, J., (2006). An evaluation of the sustainability of a rural water rehabilitation project in Zimbabwe. *Physics and Chemistry of the Earth,* 31: 699-706.

Howard, A.G., (2002). *Water Quality Surveillance: A practical guide*. WEDC, Loughborough University, UK. Available at http://www.lboro.ac.uk/wedc/publications [accessed January 2010]

Hopkins, O.S., Lauria, D.T., Kolb A ., (2004). Demand-Based Planning of Rural Water Systems. Jo*urnal of Water Resources Planning and Management,* 130, 1.

Hueb, J.A., (2006). *Rapid Assessment of Drinking Water Quality. Joint MonitoringProgram.* Presentation at the Mexico World Water Forum, March 2006.

Hukka, J.J., Katko, T.S., (2003). Refuting the paradigm of water services privatization. *Natural Resources Forum*, 27: 142–155.

Human Rights Council, 2008. *Human rights and access to safe drinking water and sanitation* . Resolution 7/22. 41st meeting, 28 March 2008.

Hunter, P.R., Pond, K., Jagals, P., Cameron, J., (2009). An assessment of the costs and benefits of interventions aimed at improving rural community water supplies in developed countries. *Science of the Total Environment* 407: 3681–3685.

International Conference on Water and the Environment (1992). *The Dublin Statement and Report of the Conference.* Development Issues for the 21 century. 26–31 January. Available at http://www.wmo.ch/pages/prog/hwrp/documents/english/icwedece.html [accessed January 2010]

Jankowski, P. (2009). Towards participatory geographic information systems for community-based environmental decision making. *Journal of Environmental Management,* 90: 1966–1971.

Jiménez, A., Pérez-Foguet, A., (2007). Quality and sustainability aspects in water access indicators: an example from Same District, Tanzania. *Proceedings of the 33rd WEDC International Conference.*

Jiménez, A., Pérez-Foguet, A., (2008). Improving water access indicators in developing countries: a proposal using water point mapping methodology. *Water Science & Technology: Water Supply*, 8(3): 279–287.

Jiménez, A., Pérez Foguet, A., (2009). International Investments in the Water Sector. *International Journal of Water Resources Development*, 25 (1): 1-14.

Jiménez, A., Pérez-Foguet, A., (2009b). Access to safe and year round functional water: an estimation of coverage for three central regions in Tanzania. *Proceedings of the 34th WEDC International Conference, Addis Ababa, Ethiopia, 2009.*

Jiménez, A., Pérez-Foguet, A., (2009c). Consequences of low sustainability in the effectiveness of national strategies to increase water access in the rural areas: evidence from three central regions of Tanzania. *Proceedings of the 1st IWA Development Congress, México, 2009.*

Jiménez, A., Molinero, J., Pérez-Foguet, A., (2009). Monitoring Water Poverty: A vision from development practitioners. In: *Water Ethics. Marcelino Botín Water Forum 2007*. Taylor and Francis Group. ISBN- 13:978-0-415-47303-3.

Jiménez, A., Pérez-Foguet, A. (2010a). Building the role of local government authorities towards the achievement of the right to water in rural Tanzania. *Natural Resources Forum*. In press.

Jiménez, A., Pérez-Foguet, A., (2010b). Challenges for water governance in rural water supply: lessons learnt from Tanzania. *International Journal of Water Resources Development*. In press.

Jiménez, A., Pérez-Foguet, A., (2010c). Targeting the needs in the water sector: the potential of water point mapping. A case study from Tanzania. *Proceedings of the Biennial Conference of the Water Institute of Southern Africa*. South Africa, 2010.

Johnson, D.M., Hokanson ,D.R., Zhang ,O., Czupinski , K.D., Tang, J.(2008). Feasibility of water purification technology in rural areas of developing countries. *Journal of Environmental Management* 88, 416–427.

Joint Monitoring Programme, (2009). *Tanzania data summary sheet*. Accesible at http://mdgs.un.org/ [accessed January 2010]

Jütting, J., Corsi, E., Kauffmann, C., Mcdonnell, I., Osterrieder, H., Pinaud, N., Wegner, L.(2005). What Makes Decentralisation in Developing Countries Pro-poor?. *The European Journal of Development Research*,17 (4): 626-648.

Kiefer, T., Brölmann, C., (2005). Beyond State Sovereignty: The Human Right to Water. *Non-State Actors and International Law,* 5: 183–208.

Lawrence, P., Meigh, J., Sullivan, C., (2002). *The Water Poverty Index: An International Comparison*. Keele Economics Research Papers KERP 2002/19.

Lawson, A., Rakner, L., (2005). *Understanding Patterns of Accountability in Tanzania: Final Synthesis Report.*

Lee, T., Floris, V., (2003). Universal access to water and sanitation: Why the private sector must participate. *Natural Resources Forum*, 27: 279–290.

Leemis, L.M., Trivedi, K.S.,(1996). A Comparison of Approximate Interval Estimators for the Bernoulli Parameter, *The American Statistician* 50 (1): 63-68.

Luby, S. P., Mendoza, C., Keswick, B. H., Chiller, T. M., Hoekstra, R. M., (2008). Difficulties in bringing point-of-use water treatment to scale in rural Guatemala. *American Journal of Tropical Medicine and Hygiene*, 78 (3): 382–387.

Maro, P.S., (1990). The impact of decentralization on spatial equity and rural development in Tanzania. *World Development*, 18(5): 673–693.

Mathew, B. (2004). WAMMA – Scaling up water and sanitation in rural Tanzania. *Waterlines*, 23 (2).

Mehta, M., Fugelsnes, T.,Virjee, K., (2005). Financing the Millennium Development Goals for Water and Sanitation: What Will it Take?. *International Journal of Water Resources Development*, 21 (2): 239–252.

Mora, A., Mac-Quhae, C., Calzadilla, M., Sánchez, L., (2009). Survey of trace metals in drinking water supplied to rural populations in the eastern Llanos of Venezuela. *Journal of Environmental Management* 90: 752-759.

Mukherji, A. (2006). Is intensive use of groundwater a solution to world's water crisis? In: *Water Crisis: Myth or Reality?* Marcelino Botin Water Forum 2004 (Eds.: P. Rogers, M.R. Llamas & L. Martínez Cortina). Taylor and Francis, London, UK: 181–193.

Muyibi, S.A., (1992). Planning water supply and sanitation projects in developing countries. *Journal of Water Resources Planning and Management*, 118 (4), Paper No. 1445.

Mwanza, D., (2003).Water for sustainable development in Africa. *Environment, Development and Sustainability* 5: 95-115.

Nyerere, J. ,(1971). *TANU ten years after independence*. Report submitted to the TANU National Conference, Dar Es Salaam, September 1971.

Nyerere, J., (1981). As quoted in Daily News,21 October 1981.

Organization for Economic Cooperation and Development (2005). *Decentralisation and Poverty Reduction*. In , Johannes Jütting, Elena Corsi and Albrecht Stockmayer. Policy Insights, no 5. Available at www.oecd.org/dev/insights [accessed January 2010]

Organization for Economic Cooperation and Development (2006) Development Statistics. Available at www.oecd.org/topicstatsportal/0,2647,en_2825_495602_1_1_1_1_1,00.html [accessed January 2010]

Organization for Economic Cooperation and Development (2007). *Development Statistic portal*: Available at http:// www.oecd.org/dac/stats/idsonline. [accessed January 2010]

Overseas Development Institute, (2003). Secure Water? Poverty, Livelihoods and Demand-Responsive Approaches. *Policy Brief*, 4. Available at www.odi.org.uk/rpeg/wpp/. [accessed January 2010]

Paavola, J., (2008). Livelihoods, vulnerability and adaptation to climate change in Morogoro, Tanzania. *Environmental Science and Policy*, 11: 642–654.

Pascual, J., Jiménez, A., Pérez-Foguet, A. (2009). SIS: Aplication of GIS for monitoring ISF-ApD Water & Sanitation programmes. *Cuadernos de Tecnología para el Desarrollo Humano*. Available at www.cuadernos.tpdh.org/ [accessed January 2010]

Quinn,C.H., Huby, M., Kiwasila, H., Lovett, J.C. ,(2003). Local perceptions of risk to livelihood in semi-arid Tanzania. *Journal of Environmental Management* 68: 111–119.

Ramsey, K., (2009). GIS, modeling, and politics: On the tensions of collaborative decision support. *Journal of Environmental Management* 90: 1972–1980.

Rajabu, K.R.M., (2005). The role of participatory problem analysis in performance improvement and sustainable management of rainwater harvesting (RWH) systems: A case study of Makanya village,Tanzania. *Physics and Chemistry of the Earth 30: 832–839.*

Rao, S. V. R.,Rasmussen, J. A., (1987). Technology of small community water supply systems in developing countries. *Journal of Water Resource Planning and Management,* 113 (4), Paper No. 21638.

Reimann ,C. Bjorvatn K., Frengstad, B. , Melaku Z., Tekle-Haimanot R. and Siewers, U., (2003). Drinking water quality in the Ethiopian Section of the East African Valley-data and health aspects. *Science of the Total Environment* , 311: 65-80.

Reimann ,C., Banks, D., (2004). Setting action levels for drinking water: Are we protecting our health or our economy (or our backs!)?. *Science of the Total Environment*, 332: 13– 21.

Ribot, J.C., Agrawal, A., Larson, A.M., (2006). Recentralizing while decentralizing: how national governments reappropriate forest resources. *WorldDevelopment* 34 (11): 1864–1886.

Rogers, P., Hall, A.W., (2003). *Effective Water Governance.* Global Water Partnership Technical Committee (TEC). Published by Global Water Partnership. ISBN: 91-974012-9-3.

Rural Water Supply and Sanitation Network (2009). Available at http://www.rwsn.ch/prarticle.2005-10-25.9856177177/prarticle.2005-10-26.9228452953.
[accessed January 2010]

Same District Council (2006). *Serious Water Shortage in Same District*. District Water Department, February 2006, Same.

Same District Council (2009). *New water supply and sanitation services priorities in Same District*. September 2009. Same District Water Department , P.O.Box 7, Same, Tanzania.

Same District Council (2009b). *District Water and Sanitation Unit Support*. July 2009. District Water Department, P.O.Box 7, Same, Tanzania.

Same District Council (2009c). *Kanuni na taratibu za DWUS*. Version 1.2. December 2009. District Water Department, P.O.Box 7, Same, Tanzania.

Savenije, H.H.G., (2002). Why water is not an ordinary economic good, or why the girl is special. *Physics and Chemistry of the Earth*, 27: 741–744.

Savenije, H.H. G., van der Zaag, P., (2002). Water as an Economic Good and Demand Management Paradigms with Pitfalls. *Water International*, 27 (1): 98-104.

Schmidt, W., Cairncross, S., (2009). Household Water Treatment in Poor Populations: Is There Enough Evidence for Scaling up Now?. *Environmental. Science and Technology*, 43 (4): 986-992.

Shah, A., (1998). Balance, Accountability, and Responsiveness Lessons about Decentralization. *Policy research working paper 2021*. The World Bank Operations Evaluation Department. Country and Regional Evaluation Division, Washington DC, USA.

Shah, A., Thompson, T., Zou, H., (2004). The impact of decentralisation on service delivery, corruption, fiscal management and growth in developing and emerging market economies: a synthesis of empirical evidence. *CESifo DICE Report 1/2004*. Available at http://info.worldbank.org/etools/docs/library/206896/TheImpactofDecentralisation.pdf. [accessed January 2010]

Smoke, P., Lewis, B.D., (1996). Fiscal decentralization in Indonesia: A new approach to an old idea. *World Development*, 24 (8): 1281-1299.

Songorwa, A.,N., (1999). Community-Based Wildlife Management (CWM) in Tanzania: Are the Communities Interested? *World Development*, 27 (12): 2061–2079.

Steiner, S., (2007). Decentralisation and poverty: conceptual framework and application to Uganda. *Public Administration and Development,* 27: 175–185.

Stoupy , O., Sudgen, S., (2003). *Halving the Number of People without Access to Safe Water by 2015 – A Malawian Perspective. Part 2: New indicators for the millennium development goal*. WaterAid Malawi. Private bag 364, Lilongwe 3, Malawi.

Sugden, S., (2001). Assessing sustainability. The sustainability snap shot. *Proceedings of 27th WEDC International Conference*. Lusaka, Zambia.

Sullivan, C.A., (2002). Calculating a Water Poverty Index. *World Development*, 1290.

Sullivan, C.A., Meigh, J., (2007). Integration of the biophysical and social sciences using an indicator approach: Addressing water problems at different scales. *Water Resources Management*, 21: 111–128.

Sullivan, C.A., Meigh, J.R., Giacomello, A.M., Fediw, T., Lawrence, P., Samad, M., Mlote, S., Hutton, C., Allan, J.A., Schulze, R.E., Dlamini. D.J.M., Cosgrove, W., Delli Priscoli, J., Gleick, P., Smout, I., Cobbing, J., Calow, R., Hunt, C., Hussain, A., Acreman, M.C., King, J., Malomo, S., Tate, E.L., O'Regan, D., Milner, S., Steyl, I., (2003). The Water Poverty Index: development and application at the community scale. *Natural Resources Forum*, 27: 189–199.

Tanzania Society (1975). *Water Supply; service to the Nation to speed development* Tanzania notes and records, 76 . Tanzania Society, POBox 511, Dar es Salaam.

Tekle-Haimanot, R., Melaku, Z., Kloos, H., Reimann, C., Fantaye, W., Zerihun, L., Bjorvatn, K., (2006). The geographic distribution of fluoride in surface and groundwater in Ethiopia with an emphasis on the Rift Valley. *Science of the Total Environment* 367: 182–190.

The Guardian (2006). *Starving villagers in Same survive on wild fruits*. The Guardian. By Patrick Kisembo, Ndungu. Published on the 27th February 2006.

The Guardian (2009). *Tough time ahead as food shortage looms*.The Guardian. By Polycarp Machira. Published on the 16th August 2009.

Therkildsen, O., (1988). *Watering White Elephants? Lessons from Donors Funded Planning and Implementation of Rural Water Supplies in Tanzania*.. Scandinavian Institute of African Studies, Uppsala. Table 3,page 49.

Tindimugaya, C., (2004). Groundwater mapping and its implications for rural water supply coverage in Uganda. *Proceedings of the 30th WEDC International Conference*.

Toubkiss, J., (2006). *Costing MDG Target 10 on Water Supply and Sanitation: Comparative Analysis, Obstacles and Recommendations*, 3rd World Water Forum, México 2006.

Turgeon , S., Rodriguez , M.J., Thériault ,M., Levallois, P. , (2004). Perception of drinking water in the Quebec City region (Canada): the influence of water quality and consumer location in the distribution system. *Journal of Environmental Management* 70: 363–373.

United Nations (2002). *The Right to Water*. Economic and Social Council Committee on Economic, Social and Cultural Rights, E/C.12/2002/11, General Comment No. 15. November 26th 2002.

United Nations (2003). *Indicators for Monitoring the Millennium Development Goals*. Publication number ST/ESA/STAT/SER.F/95. United Nations. New York, USA

United Nations (2004). *United Nations declaration 58/217*. 9th February 2004.

United Nations (2005). *Health, Dignity, and Development. What will it take?* Millennium Project, United Nations, New York.

United Nations (2005b). *Press Note: SG/SM/9888 DEV/2513*. 25th May 2005.

United Nations (2007).International Year of Sanitation, 2008. *Resolution 61/192.* 6th February 2007.

United Nations Development Programme (2005). *Human Development Report, 2005*. Available at: http://hdr.undp.org/en/reports/global/hdr2005/.
[accessed January 2010]

United Nations Development Programme (2006). *Human Development Report 2006: Beyond scarcity: Power, poverty and the global water crisis*. Available at http://hdr.undp.org/en/reports/global/hdr2006/
[accessed January 2010]

United Nations Development Program (2007). *Statistics by country*. http://hdr.undp.org/en/reports/global/hdr2007-2008/
[accessed January 2010]

United Nations Development Program (2009). *Human development report*. Available at http://hdr.undp.org/en/reports/global/hdr2009/.
[accessed January 2010]

United Nations Statistic Division, (2009). Tanzania Country sheet, in *World Statistics Pocket book*. Available at http://data.un.org/. [accessed January 2010]

van Norden, H., (2007). *Monitoring the MDG drinking water and sanitation target : Definitions, Indicators and their measurability*. Joint Monitoring Program. Presentation at the Stockholm Water Week, 16 August 2007.

Van Wonderen, J., Ravenscroft, P., (2000). GIS and modelling in the management of rural water supply. *Proceedings of the 26th WEDC International Conference.*

Vasquez , W.F., Mozumder , P., Hernández-Arce , J., Berrens, R.P., (2009). Willingness to pay for safe drinking water: Evidence from Parral, Mexico. *Journal of Environmental Management* 90: 3391–3400.

Water and Sanitation Program (2006). *Sistemas de información sectorial en Agua y Saneamiento en América Central*. Memoria analítica del taller internacional San Salvador-septiembre 2006. Available at http://www.wsp.org. [accessed January 2010]

Water and Sanitation Program (2007). *Country-level Sector Information and Monitoring Systems (SIMS) for Water and Sanitation in Africa. Practitioners'* Workshop, Nairobi, Kenya, March 2007. Available at http://www.wsp.org [accessed January 2010]

Wateraid, ODI (2005). *Learning for advocacy and good practice-WaterAid water point mapping*. Prepared by Katharina Welle, Overseas Development Insitute. Available at http://www.wateraid.org/international/what_we_do/policy_and_research/ [accessed January 2010]

Wateraid (2005). *Mozambique Water sector Assessment*. Available at: http://www.wateraid.org/uk/what_we_do/where_we_work/mozambique/3985.asp [accessed January 2010]

Wateraid (2009). *Waterpoint Mapping, Planning and Obstacles to Equity in Rural Water Supply. A Review in Mpwapwa, Kongwa, Iramba and Nzega.* Prepared by Ben Taylor. WaterAid Tanzania, June 2009. PO Box 33759, Dar es Salaam.

WHO (1997). Guidelines for drinking-water quality, Volume 3 Surveillance and control of community supplies. Geneva. Available at http://www.who.int/water_sanitation_health/dwq/gdwq2v1/en/index2.html. [accessed January 2010]

WHO (2006). *Core questions on drinking-water and sanitation for household surveys*. WHO Library Cataloguing-in-Publication Data World Health Organization and UNICEF 2006. Page 5. . Available at http://www.who.int/water_sanitation_health/monitoring/household_surveys/en/index.html. [accessed January 2010]

WHO/UNICEF (2000). *Global Water Supply and Sanitation Assessment 2000 Report*. World Health Organization Press. Geneva, Switzerland

WHO/UNICEF (2005). *Water for Life. Making it happen*. WHO/UNICEF Joint Monitoring Programme for Water Supply and Sanitation. World Health Organization Press. Geneva, Switzerland.

WHO, UNICEF (2008).*Progress on drinking water and Sanitation: Special focus on Sanitation.* Joint Monitoring Programme for Water Supply and Sanitation. World Health Organization Press. Geneva

World Bank (1997). *Making Rural Water Supply Sustainable: Recommendations from a Global Study*. Water and Sanitation program. Report by Travis Katz Jennifer Sara. Available at http://www-wds.worldbank.org. [accessed January 2010]

World Bank, (1998). *Community Water Supply and Sanitation Conference*. Water and Sanitation program Available at http://www-wds.worldbank.org/external/default/main?pagePK=64193027&piPK=64187937&theSitePK=523679&menuPK=64187510&searchMenuPK=64187511&theSitePK=523679&entityID=000009265_3981005112156&searchMenuPK=64187511&theSitePK=523679 [accessed January 2010]

World Bank (2003). *Infrastructure Action Plan*, World Bank, Washington DC,2003.

World Bank (2006). *Private Participation in infrastructures database*. Avaiable at http://ppi.worldbank.org. [accessed January 2010]

World Bank (2008). *Implementation Completion and results report (IDA-36230, IDA-3623A) on a credit in the amount of SDR20.8 Million (US$26.00 Million equivalent) to the United Republic of Tanzania for a Rural Water Supply and Sanitation Project.* Report No:ICR 0000730. Page 37.

World Bank (2009). *Tanzania Public Expenditure Review of the Water Sector*. September 2009. Report number 50905. Available at http://web.worldbank.org/WBSITE/EXTERNAL/TOPICS/EXTWAT/0,,contentMDK:21706928~menuPK:4602430~pagePK:148956~piPK:216618~theSitePK:4602123,00.html [accessed January 2010].

World Summit on Sustainable Development (2002). *Plan of Implementation*. Johannesburg, September 2002.