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Urban Water Services in Sub Saharan Africa: Access, Private Sector Involvement and Technical Paradigm.

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List of Acronyms

AC Average Cost

AIC Average Incremental Cost

AICD Africa Infrastructure Country Diagnostic

BOT Build, Operate Transferù

CM Cubic Meter

CoJ City of Johannesburg

DFID Department for international development -UK

EIB European Investment Bank

HR Human Resources

IBNET International Benchmarking NETwork

IBT Increasing Block Tariff

IFI International Financial Institution

IMF International Monetary Fund

IWRM Integrated Water Resource Management

LIA Low Income Area

LMIC Lower and Middle Income Country

LRMC Long Run Marginal Cost

LPCPD Liters Per Capita Per Day

LWB Lilongwe Water Board

KMU Kiosks Management Unit

KPI Key Performance Indicator

MIC Marginal Incremental Cost

MCC Marginal Capacity Cost

MDG Millennium Development Goal

MKW Kwacha (Malawian currency)

MOC Marginal Operating Cost

NPV Net Present Value

NRW Non Revenue Water

ODA Official Development Assistance

OLS Ordinary Least Squares

O&M Operation and Maintenance

PIU Projects Implementation Unit

PPP Public Private Partnership

PSI Private Sector Involvement

PSP Private Sector Participation

RPI Retail Price Index

SOE State Owned water Enterprise

SRMC Short Run Marginal Cost

SSA Sub Saharan Africa

TTT Tariffs, Taxes, Transfers

UFW Unaccounted For Water

UN United Nations

WB World Bank

WDM Water Demand Management

WOP Water Operators Partnership

WSP water and sanitation program

WTP Willingness to Pay

WUA Water Users Association

2SLS Two Stages Least Squares

Introduction

The thesis analyses the water supply sector in the Sub Saharan African region, focusing on the challenges experienced by the water utilities to fulfil their mandates, in a context of rapid urbanization.

In September 2000, building upon a decade of major United Nations (UN) conferences and summits, world leaders came together at UN Headquarters in New York to adopt the Resolution A/RES/55/2, committing their nations to a new global partnership to reduce extreme poverty and setting out a series of time-bound targets - with a deadline in 2015 - that have become known as the Millennium Development Goals (MDG). The goal number 7 was “Ensure environmental sustainability” and it included the Target 7.C which is to “halve, by 2015, the proportion of the population without sustainable access to safe drinking water and basic sanitation”.

The water MDG is dramatically off track in Sub Saharan Africa, with only 64% of the population covered in 2012 instead of the expected 77.5% (WHO and UNICEF 2014). These poor performances are driven by urban areas, where the water supply coverage through household connections declined while the access through other improved sources, like public taps, private hand pumps and protected wells, hardly compensated for that.

This calls for a reconsideration of the policies implemented in the sector following the prescriptions of the neoliberal agenda for the sector. In the ‘80s and ‘90s policymakers from International Financial Institutions (IFIs) and donors agencies designed a set of recipes to address poor performances of the urban water services in the developing world. This happened in the context of structural adjustment policies, such as trade liberalization, labor market reforms, financial deregulation and privatization of State Owned Enterprises (SOE). In the water sector, these orientations were translated into decentralization, private sector participation, commercialization and corporatization of water utilities, with the shift of governments from providers to regulators.

The thesis studies some of the devices and solutions typically adopted by the reformed utilities and justified by the expectation of positive outcomes for the access to water by the poor

The work shows however that some of these devices gained a certain degree of autonomy from access goals and became a priority as such, to be pursued by water utilities regardless their impacts and interaction with key social dimensions. This phenomenon was in some cases favoured by a biased attitude of water sector practitioners, benchmarking regulation and donors.

The work highlights that in some cases the reform solutions do not contribute to the achievement of the declared objectives, while their implementation can divert scarce resources and attention from key sector priorities.

Cost recovery, Private Sector Participation and household level metering issues are analysed.

The work is organized in three parts.

The first part proposes a review of the main notions and issues addressed by water economics (chapter 1), with particular attention to developing countries.

The second part is divided into three chapters, closely linked together for their arguments but conceived as autonomous papers and characterized by different methodological approaches: the first is quantitative, the second and the third are more qualitative in nature and they include original findings from interviews on the Lilongwe Water Board, a water utility from Malawi.

The second chapter focuses on the problems of cost recovery and access to drinking water in Sub Saharan Africa. A model explaining the dynamics in water coverage which accounts for financial performances of utilities is proposed. The data set covers 25 countries in the Sub Saharan region from 1995 to 2012. The results suggest that the access to water depends upon financial results, but this relationship is not linear: with increasing returns for relatively low levels of cost recovery and decreasing returns beyond a certain threshold. The results are consistent with the literature about the risks associated with corporatization and neoliberal reforms in the water sector, and they provide some supporting quantitative evidence and recommendations for sector policies in the region. The study was submitted, jointly with Dr. Ivan Savin from the University of Jena, to "World Development" and it was accepted for publication in June 2015. An abstract was also accepted and presented at the International Water Association (IWA) conference WATERIDEAS, held in Bologna in October 2014.

The third chapter refers to the Light Private Sector Involvement initiatives in the Sub Saharan Africa water supply sector, considering in particular efficiency improvements, aid effectiveness and related policy implications. The study analyses the determinants that can incentivize or discourage the partners of light forms of Private Sector Involvement (PSI) initiatives to achieve the expected results in the water supply sector in the Sub Saharan Africa region. This is done through a review of case studies involving management and service contracts, which are the lightest and lower risk forms of public-private partnership. While five cases are taken from the available literature, the sixth includes contributions from original research on Lilongwe Water Board (Malawi). The chapter considers the incentives to perform for both the private and the public partner, as determined by the contracts and by the wider context. The incentives necessary for both parties to engage in the partnership are also considered, jointly with the costs of creating these preconditions. The study concludes that the allocation of risks and decision making power are among the drivers of poor performances by light PSI initiatives. Moreover, as most partnerships are financed by development projects, the study discusses the policy implications of promoting these PSI initiatives. The study was submitted, jointly with Professor Elena Maggi, to the 3rd Global WOPs Congress 2015, organized by GWOPA UN-HABITAT in Barcelona for September 2015.

The fourth chapter analyses the priorities and tools for Water Demand Management in urban Africa, focusing on household level water metering. The study presents an analysis of the issues associated with water metering at household level by utilities in low income areas or informal settlements of Sub Saharan African cities. Metering is considered a key tool for water demand management and recommended as a good practice in the water supply sector but, while its benefits are clearly spelled out by donors and development agencies, its costs and shortcomings are seldom considered. The chapter analyses such challenges, based on the available literature and on an original case study on Lilongwe Water Board (Malawi). It is argued that the technical paradigm of metered household level connection can be in some cases a constraint to the connection of low income households, due to the high cost and complexity of the practices associated to this paradigm, while the benefits in terms of demand management are not straightforward. Some alternatives to universal household level metering are also identified.

Finally, in the last part of the work the findings from the studies presented are summarized and some conclusions and recommendations are drawn about the importance of better focusing on the priority of water access, encompassing a wider set of operational solutions.

1 Water services industry: economics and regulation theory

The chapter presents a short review of the main issues analysed by the economics theory on water supply and of the tools developed to address them, providing the theoretical framework at the basis of the next chapters.

The first part of the chapter identifies the features which make water a *public good* or at least an imperfect private good and it introduces the main trade-offs faced when trying to allocate it through markets. Then the features of the demand and the supply of water services are also explained.

The section on Water Supply presents the returns to scale that characterize the water supply industry and the possible approaches to Cost Recovery from users' tariffs. These depend upon the share of costs to be charged on users, the distribution of fixed costs on unit prices and the consideration of positive externalities in public health and negative environmental externalities.

The paragraph on Water Demand analyses the environmental externalities problems which make Demand Management necessary in water markets and it presents how contingent valuation is used to estimate demand functions in the absence of competitive markets.

The first part of the chapter ends with the presentation of tariff structures and price discrimination in the water sector, with a focus on Increasing Blocks Tariffs as a tool for demand management and to achieve distributional goals.

The second part of the chapter presents the main forms of regulation. These include command and control regulations and forms of regulation based on the notion of competition. The latters can introduce competition among private firms bidding for a market, or they can regulate firms by simulating competition between markets. The main challenges faced by regulators in developing countries and in Africa are also introduced.

1.1 The public good features of water resources and water services

The concept of water as an economic good came up during the preparatory meetings for the Earth Summit in Rio de Janeiro of 1992. It was brought forward during the Dublin conference on Water and the Environment (ICWE, 1992), and became the fourth Dublin Principles: *"Water has an economic value and should be recognized as an economic good, taking into account affordability and equity criteria."* Moreover, economists have been working about water long before the 1992 and they had a role in shaping the policies related to water supply. Economic goods can be broadly classified into four ideal categories, depending upon their excludability and rivalry, as shown in Table 1.1.

Table 1.1 Public and private goods

	Rival	Non rival
Excludable	Private goods	Natural Monopolies
Non excludable	Common goods	Public goods

Source: Mankiw and Taylor 2014

The classification of water under these categories is somehow critical, due to two reasons. The first reason lies in the fact that these categories should be intended as ideal types, with real world goods only approximating their features. The second reason is related to the relative emphasis placed on man-made systems for water supply and on water as a natural resource respectively, which could result in different classifications.

The present study will focus on man-made systems for water supply, but, according to Integrated Water Resources Management Principles (ICWE 1992), it is important to recognize the close interdependence between the environmental and the technical dimensions.

When water services are considered, some features of the natural monopoly can be identified. A natural monopoly is a condition of an industry whereby, due to the features of costs and technology, it is most efficient for production to be concentrated in a single firm. The largest, or first, supplier in a market is provided with an overwhelming cost advantage over actual and potential competitors. This is usually the case in industries where capital costs predominate, creating economies of scale and hence high barriers to entry, like utilities operating in the water supply sector. Annual per capita Operation and Maintenance Cost (O&M cost) for Africa can be estimated as 1.5% to 3% of per capita cost of capital (Banerjee and Morella 2011). It is therefore more efficient to increase the output and divide the fixed cost among large number of customers, since average total cost declines as output increases. This, in terms of the categories introduced in Table 1.1, approximates water supply to the case of "non rival consumption".

When water is considered as a natural resource, some features of common goods can be identified. In the case of common goods it is costly to exclude potential beneficiaries from obtaining benefits from their use but, unlike pure public goods, they face problems of congestion or overuse, because they are subtractable, leading to the so called "tragedy of the commons". Water appropriation or deterioration (for example through land uses which compromise infiltration or by polluting water bodies) at one stage of the water cycle can prevent consumption at another stage or downstream. Furthermore, being water a renewable resource, when its rate of consumption exceeds the rate of reproduction (rainfalls, watersheds recharge,…), its total availability is compromised and the capacity of the ecosystem to recover original service production capacity might be affected as well. This is again the case for externalities, since the costs borne by the users community in the long run overwhelmingly exceed the price paid by the users who are over-consuming the resource.

Common goods, or common pool resources, can be made sustainable thanks to an institutional, formal or informal arrangement and there is a wide economic literature focusing on the role of institutions in ensuring stable common pool resource management, particularly at the local and community level (Ostrom, 1990).

Both the consideration of water in terms of water services and of natural resource revealed some features which are not the ones of an ideal private good. Externalities should also be considered. The existence of positive externalities makes it appropriate to compare the costs of water supply services to the total benefits provided by water supply, which should include both the social and the private ones. Water provision clearly gives private benefits to the receiving household. However, if people are unwilling or cannot afford to purchase enough safe water to protect their own health, the health of others is also put at risk. Public benefits of water and sanitation systems are thus related to the provision of public protection from communicable diseases. For this reason the benefits of having an additional user include both the user's private benefits and the related external (social) benefits.

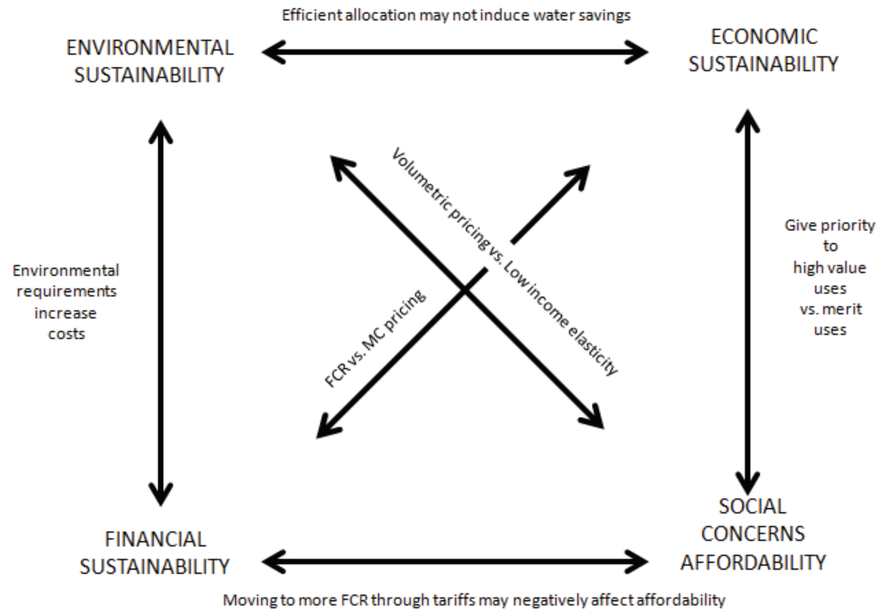
This does not necessarily have implications over the option for private or public provision, but is generally recognized at least as a reason for regulation (see 1.2). The need for economic regulation is due to the existence of significant market failures resulting from economies of scale and scope in production, from information imperfections in market transactions, from the existence of incomplete markets and externalities, and from income and wealth distribution (Amann, 2006).

Market allocation is based on prices. In microeconomics, the price will be optimum where the marginal willingness to pay (see 1.5) and the marginal cost curves cut each other, respectively approximating demand and supply. This point should correspond to an efficient allocation of water services, from an economic standpoint. However, as competitive markets for water services do not exist in real world settings, the equilibrium point cannot be automatically reached and specific methodologies are used to estimate both the willingness to pay and the marginal cost functions (see 1.1). Moreover, it is widely recognized that the economic perspective is not the only relevant to water pricing. For example, water pricing is both an allocation mechanism and a revenue raising instrument.

A number of trade-offs can be identified if water policies, and more particularly pricing policies are considered in the view of the multiple objectives they pursue. These objectives include financial, economic, environmental and social sustainability.

Environmental sustainability is about guaranteeing the preservation of water ecosystem services and natural capital, encouraging water saving technologies and discouraging wasteful behaviours. Financial sustainability is about guaranteeing the long term reproduction of physical assets, through cost recovery. Economic efficiency includes the allocation of water to the most beneficial uses and usually associated to marginal cost pricing. Social concerns are related with affordability and equity for lower income consumers.

Figure 1.1 Trade - offs among pricing objectives



Source: based on Massarutto A. 2007 and OECD 2010

The trade-offs between these objectives are represented in Figure 1.1, while some of them are briefly discussed below:

- Financial sustainability and affordability: full cost recovery through tariff is often envisaged to ensure financial sustainability buy it can negatively affect affordability by lower income users.
- Environmental and financial sustainability: environmental requirements increase the cost of water (through compensation mechanism or through the adoption of environmental friendly technologies). This increases the burden over any source of finance which can sustain water supply creating potential tension between the environmental concerns and financial cost recovery.
- Economic sustainability and social concerns can conflict because merit uses are not necessarily uses associated with the highest economic values.

- Environmental and social concerns might conflict: being water an increasingly scarce resource, price is an instrument to provide incentives toward water saving and water tariffs are a tool of demand management approaches, since they inform users, including polluters, about the value of the resource. However, access to sustainable affordable water services has to be ensured to the largest possible number of people, increasing the production and supply of drinking water.
- Economic and financial sustainability: pricing water to achieve full cost recovery might also conflict with economic efficiency which calls for marginal cost pricing, as it will be discussed in the next paragraph.

1.2 Water Supply

In the estimation of production and cost functions of the water industry and particularly of the provision of utility services, the major areas of interest are model specification, returns to scale and cost recovery.

An often adopted model for the specification of the water production function is the Cobb-Douglas production form or its generalization, the translog (transcendental logarithmic) production function (Altmann 2007).

Concerning returns to scale, water supply businesses are characterized by substantial fixed costs and economies of scale. Furthermore utilities are often required to retain substantial spare capacity to cope with peak demand and shortages, so that marginal cost is usually lower than average costs in the relevant demand range. Yet, marginal costs are not stable in the short run, since short run marginal costs fall to zero following each extension of capacity and then rise to full cost as capacity becomes exhausted, and so on. Furthermore marginal cost can be increasing, as a result of water scarcity which makes the development of new sources increasingly costly.

The issue of cost recovery is related to the financial sustainability of water utilities and it refers to the political will and practical feasibility of recovering the costs of water supply from tariffs charged on water users. Cost recovery implies the understanding of how costs are composed and the identification of the share of costs to be recovered. Costs include construction, operation and maintenance, and replacement of parts when needed throughout the life cycle of the water systems. The full financial cost can be decomposed as follows:

- Operation and maintenance costs (O&M) related with daily running of the water supply system, such as costs of electricity for pumping, chemical inputs for water treatment, labor and repair;

- Capital cost, covering the investment both for the renewal of existing infrastructure and for new infrastructure. Depreciation costs are sometimes considered as well (Majumdar 1991);
- Interest on capital: costs of servicing debt or, in case of equity, return on capital invested are sometimes considered as well (Majumdar 1991).

A full economic cost, according to OECD (2010), is a broader concept than full financial costs and should include, jointly with the costs above:

- Opportunity costs, or resource costs: reflecting the scarcity of the resource and corresponding to the cost of depriving the next possible user;
- Economic externalities: including negative externalities like upstream diversion of water, release of pollutant downstream, but also positive ones.

In the 2000s, the policy debate has moved the attention from a call for full costs recovery through tariffs (usually referring to financial costs alone) toward the concept of sustainable cost recovery, first introduced by the Camdessus report (Winpenny 2003) and particularly important for developing countries. Sustainable cost recovery allows for a mix of Tariff, Taxes and Transfers (TTT), recognizing the importance of affordability.

Urban water supply in Africa was sometimes separated from unprofitable elements like sanitation and rural water supply to make it more commercially viable. Separation from sanitation however is not in line with Integrated Water Resources Management (IWRM) principles. The need to rely only on tariffs can provide adverse incentives to the extension of networks to poorer areas, as the poor can be perceived by operators as an unprofitable market. This issue will also be addressed in the 3rd chapter. The possible criteria for spreading the cost of water services can thus be viewed along a continuum between endogenous and exogenous solutions, with purely endogenous solutions mainly relying on users for cost recovery and purely exogenous solutions transferring all the costs to external actors (people located elsewhere, future generations). A variety or intermediate solutions are available, like cross subsidies among users, territorial cross subsidies, cross subsidy between different services, general taxation and direct/indirect subsidies.

According to the economic theory, prices should be set at marginal cost since, in the absence of externalities, this approach maximizes economic welfare and sends to consumers and producers the right signals about the relative scarcity of the goods and services. Yet, as already noticed, marginal cost in the water industry is usually lower than average costs (AC) and pricing at marginal cost (MC) alone can result in the under recovery of costs. To set the price equal to MC is the first-best solution in terms of economic efficiency, but it does not ensure the recovery of fixed costs when MC is lower than AC. Furthermore, as the marginal cost depends upon the availability of spare production capacity at any given time, it is not stable, and does not offer a reliable base for pricing.

One solution is based on the idea of R. H. Coase (1946) of a two-part tariff. Incremental consumption per cubic meter of water is priced at marginal cost but a fixed charge (connection or access charge) is also set to ensure that total revenue covers total costs, as shown below:

$$Revenue\ from\ annual\ charges = \sum_{i=1}^{N}(A_i + C_i \times Q_i) \qquad (1.1)$$

Where i represent each of the *N* water users, A is the connection/ access charge, C is the volumetric charge which reflects the marginal cost of production and is multiplied by *Q*, the quantity of water consumed.

This two part tariff assumes that average costs are not rising in the relevant output range (MC is below AC), which means that the system is not close to the limits of its capacity. Otherwise, when the system is at the limits of its operating capacity, the excess of marginal cost over average cost should be counterbalanced through a negative fixed charge (transfer-subsidy) to avoid over-recovery. This is not practically feasible, so that the level of tariffs for water and wastewater is often based on average costs. A recommended, solution, also adopted by the UK regulator (OFWAT 2001), lies the use of long run marginal cost (LRMC), which should ensure both cost recovery (financial sustainability) and efficient allocation (economic sustainability). The basic difference between short run marginal cost (SRMC) and LRMC is the time frame under consideration and its implications for a firm's ability to adjust its production process, being the long run the time horizon where all costs are variable. In practice, the long run term depending on the specific cases, can be interpreted as the planning horizon, the average life of assets or the time period until the next expansion to meet the projections of demand growth (Marsen Jacob Associates 2004).

While short run marginal costs rise steeply as a result of capacity constraints and then fall down as a result of significant excess capacity which follows the expansion, long run marginal costs are much more stable and reduce the instability of tariffs charges over time (Mann et al. 1980). Moreover LRMC can account for both capital expenditure for the expansion of water supply systems and for operating costs for their functioning.

Generally, since in the water sector investments tend to create substantial spare capacity and have typically a very long life (up to 100 years), it is usually recommended to set prices adopting investment planning periods of at least 20 years and accounting for the residual value of assets beyond that date.

According to Marsen Jacob Associates (2004), LRMC can be calculated from Marginal Operating Costs (MOC) and Marginal Capacity Costs (MCC), associated with the investments that are necessary to respond to the expected increase in water demand. It should be noticed that LRMC is a forward looking concept, because historical costs are considered as “sunk costs” or costs which cannot be altered by decisions taken in the present. On the contrary, future capital costs related to system expansion are affected by bringing forward or delaying capacity expansion. One of the most common way of calculating LRMC is through Average Incremental Costs (AIC), with Marginal Incremental Cost (MIC) proposed by Turvey (1969) being the main alternative. According to Saunders and Warford (1976) definition, AIC is obtained by “*discounting all incremental costs which will be incurred in the future to provide for estimated additional demand over a specified period, and dividing that by the discounted value of the incremental output over the period”.* This means that AIC for the marginal capacity cost (MCC) is the present value of the stream of capital expenditure needed to satisfy the projected demand divided by the present value of the stream of demand itself.

Similarly, the MOCs, in the AIC approach, are given by the Net Present Value (NPV) of the stream of incremental operating expenditure needed to satisfy the projected demand divided by the present value of the stream of demand itself.

$$AIC_t = AIC_t^{MCC} + AIC_t^{MOC} = \frac{NPV\ (capex) + NPV\ (opex)}{NPV(demand)} \qquad (1.2)$$

The AIC estimates of the marginal cost smooth down the lumps in expenditure corresponding to the discrete timing of investments. The recovery of these costs is instead distributed over time, according to the trend of the actual increase in water demand.

It should be noticed that the inclusion of capital costs in the calculation of the level of unit prices should not be given for granted, both in developed and in developing country, in consideration of the cost recovery debate.

1.3 Water Demand

The consideration of the features of water demand can provide some important insights to understand the determinants of the consumption patterns that can be observed and the implications of different pricing solutions.

It is first important to notice that, while an increase in the demanded volumes is welcome by producers in most sectors, in the case of water it is recognized that demand growth should be controlled.

‘‘Water demand management’’ is a key concept in Integrated Water Resources Management. Once water scarcity is assumed and the possibility of water shortages is considered, it is clear that the so called *supply side* solutions are not the only or the best possible answer to increasing water demand. In the previous paragraph, great attention was paid to the infrastructural investments which are necessary to face increasing water demand. Nonetheless, according to demand management proponents, infrastructural investments can sometimes be substituted, or at least coupled by *demand side* interventions. These are, for example, the minimization of water losses and the attempt to influence and condition the demand toward more desirable levels. Gumbo and Van der Zaag (2002) classify water demand management measures to increase the efficiency of water use into structural and non-structural measures. Structural measures include for example retrofitting of water appliances, recycling and reuse. Non structural measures are instead related with behaviours and include awareness campaigns, restrictions on use and, notably, water tariffs.

In some cases demand side and supply side solutions are consistent. For example in many areas of Sub Saharan Africa water use is unacceptably low, so that influencing demand toward more desirable levels will imply the increase of water availability through the development of new sources of water.

In other cases, not necessarily restricted to developed world and including even some urban settings of Africa, water use is too high and water shortages may be addressed also by reducing water use and increasing efficiency (Macy 1999). Water Demand Management will also be addressed in Chapter 4 by studying water metering, a common device to reduce the waste of water and control the level of consumption.

Nevertheless, in the face of a rapid urbanization which characterizes Africa, developing new sources of water usually receives great attention, while the concept of water demand management is less implemented in practice (Mulwafu et al. 2003, Arlosoroff 1998, Stiles 1996). As noticed again by Gumbo and Van der Zaag (2002), the preference for expensive supply side solutions can also be due to political reasons and to powerful coalitions between engineers, financiers and politicians.

In the absence of competitive markets for water, economists try to estimate demand by measuring the benefit provided to users by water in terms of willingness to pay (WTP), through contingent evaluation, so that the demand curve, corresponding to the marginal benefit curve, also corresponds to the marginal willingness to pay curve. WTP is simply defined as the maximum amount that an individual is willing to pay for a good or service. WTP is very high for basic minimum water requirements which are necessary for the household to survive, while it diminishes rapidly when quantities increase, moving towards less essential water uses. These considerations explain the downward slope of the water demand curve.

According to the literature review proposed by Nauges and Whittington (2009), the first analysis of household water demand in developing countries appeared in the 1970s (White et al. 1972, Katzman 1977, Hubbell 1977). However, these studies remain limited even today, also due to specific challenges encountered in measuring WTP in developing countries. Both in rural and urban contexts of developing countries, households usually can access and use various types of water sources at the same time or in different periods. This makes the variability in the conditions of water access across households much greater than in developed country and prevents researchers to base analysis on secondary data from the water utilities only.

More particularly the following challenges about data quality and availability in developing countries can be identified (Nauges and Whittington 2009):

- Given that the households that are connected to the network often have unmetered connections, the quantity of water used at household level cannot be retrieved from water utility data and households themselves might ignore how much water they use.
- Since households have multiple potential sources of water, the models developed by researchers usually require data on all these sources, even the ones which are not chosen. For example, the option for a vendor will depend not only on the price he charges, but also on the walking distance to the well. This kind of data is often not available from standard household surveys and is to be collected on the field. The most widely used approaches to model water demand are single demand equation for particular sources or separate demand equations for households relying on different sources (with Ordinary Least Squares and Two Stages Least Squares). To identify the selected water source discrete–continuous choice approach, Tobit model and maximum likelihood method are used.
- Getting water from non-tap sources outside the house always involves collection costs that need to be taken into account to assess household behaviour properly. Furthermore also the access to piped water can be associated with some coping costs faced by households like, for example, the cost of storage tanks to cope with rationed provision (less than 24 hours supply by water utilities). As these costs are not reflected in the bill paid to the water utility, the corresponding data have to be collected elsewhere.

According to Wedgwood and Sansom (2003) there are three ways to estimate WTP:

- observing the prices that people actually pay for goods in various existing markets (in the case of water, water vendors, buying from neighbours);
- observing individual expenditure of money, time, labor etc. to obtain the goods or to avoid their loss;
- Ask people directly how much they are willing to pay for goods and services.

The first two methods are called revealed preference techniques, since they are based on observations of actual behaviours, while the third technique is based upon the so called stated preferences. The contingent valuation methodology belongs to the third group and it is probably the most widely used methodology in this field. During a WTP survey, a market for a non marketed good is described and a value contingent to this hypothetical market is obtained. The most critical part of the contingent valuation household surveys is thus the design of a realistic contingent valuation scenario in terms of level, quantity and quality of the service. Furthermore, it is not correct to rely entirely upon the "willingness to pay" of users as the only criterion for supplying them with water, because of two main limitations:

- the existence of external benefits of water use which might be not fully understood by the consumer and the relationship between improved water and improved health;
- the actual "ability to pay". Affordability is difficult to quantify and there are no official statements about its level by international organizations, but the threshold of 3-5% of disposable income/household expenditure is often quoted by donors, international financial institutions and international organization, as a thumb rule (OECD 2010).

According to Nauges and Whittington (2009), the main determinants of water demand functions in developing countries are:

- Water price: authors generally agree on the inelasticity of water demand by private connections in developing countries and estimate the value of the elasticity of between - 0.3 and - 0.6, which is similar to the one of developed countries. Unfortunately, none of the studies reviewed by Nauges and Wittington (2009) and providing estimations of price elasticity was based on researches carried out in Sub Saharan Africa. Some studies also confirm that piped water and water from other sources are substitutes, and that, as expected, households relying on piped water only have a lower price elasticity than the households which also rely on a private well (Nauges and Whittington 2009). Based on a study in urban South Africa, instead, Jansen and Schulz (2006), after splitting the data into different income groups, found a price elasticity for water demand of only –0.23 for the lowest-income group, whereas the high-income group has a price elasticity of -0.99.
- Cost of collection: Collection time/distance to water sources are significant drivers of household choice of water sources and have significant negative effect on the quantity of water collected from non-tap sources.
- Quality of water: water taste is among variables influencing water demand by households. Water quality and its safety, instead, are not significant determinants of household water-demand functions in general. This confirms the above considerations about external benefits related with public health, because people can often chose unsafe sources.
- Reliability of supply: consumption of piped water slightly increases if water is available for longer hours.

- Household socioeconomic characteristics: income (or expenditure) and education level (or literacy of the head of household) have been found to be positively associated with household option for improved water source. Income elasticity is found to be between 0.1 and 0.3. Household size is significant: larger households have a greater total water use and a lower per capita consumption, due to scale effects. A study from Kenya (Mu et al. 1990) finds that households with more women were more likely to rely on water from wells and kiosks then on vendors, probably due to their availability to carry water.

It can be noticed that given low price and income elasticity for water and the typical income distributions, raising prices is regressive and therefore reduces equity.

Many WTP and demand studies about water in developing countries found that even low-income residents are willing to pay a high price for adequate water provision. A review of the literature based on data from 47 countries and 93 utilities by the World Bank (Kariuki and Schwartz 2005) provides information about the ranges of prices charged by private alternative providers, confirming that prices of alternative sources of drinking water tend to be higher than the price of water provided by utilities. The price of water provided by carters and tanker trucks are generally found to be the highest. Nonetheless, these results should be taken with some cautions because many studies were funded by the World Bank, which used the findings to justify price increases under a pro-poor approach, or to promote private participation. The justification of price increase is based on the consideration that higher tariffs could provide finance for coverage extension to reach the poor, who were currently paying even more than the increased tariff. The private participation arguments instead, use high prices charged by informal providers to demonstrate the potential profitability of the water business and attract private operators (Budds and McGranahan 2003).

Information about alternative markets has only recently been used to analyse the actual possibilities to improve regulation coverage over these activities (see 1.6.2).

1.4 Tariffs Structures and price discrimination

Once the level of price is defined based on the cost recovery targets adopted, it is possible to identify the actual tariffs to be charged to users, also considering the features of demand and affordability problems of different categories of users.

While the discussion of the previous section (see 1.1) has considered different options for the definition of the most appropriate average tariff level, the present paragraph introduces the issue of water tariff structures. *"A tariff structure is a set of procedural rules used to determine the* *conditions of service and the monthly bills for water users in various categories or classes* (Boland and Whittington 1998 p. 2)."

According to OECD (2010), revenues from water users derive from the following components:

- a "one time" connection fee, to get the first access to the service;
- a recurrent fixed charge, which can be uniform across users or linked to some features of the user (e.g. size of supply pipe, property value);
- a volumetric rate (in a metered environment), which is applied to the volume of water consumed in the charging period and results in the volumetric charge for that period. This implies the application of a second degree price discrimination: charging a different price for different quantities, such as quantity discounts for bulk purchases;
- a minimum charge which is charged for each period, regardless the actual consumption.

The above listed elements can be combined in various ways, giving rise to the following tariffs structures:

- flat rates (in a non-metered environment), which can be uniform or differentiated based on customer characteristics, or based on the season;
- single volumetric charges (in a metered environment), computed applying one single rate to each cubic meter of water consumed. This can be associated to a fixed charge, which can be uniform across users or vary according to users characteristic and might even be negative (a coupon);
- increasing block tariffs (IBTs): it is similar to the previous one, but the volumetric rates increase with the volume of water consumed. Increasing block tariffs imply three kinds of decisions, namely the number of blocks, the volume of water associated with each block and the rate to be charged to each block;
- decreasing block tariffs: the volumetric rates decline with successive block consumption. This system is sometimes adopted for industrial users but it is not in line with the principles of environmental sustainability and it should be discouraged (OECD 2010).

Moreover, in the water supply sector third degree price discrimination is often applied. This means that a different price is charged to different consumer groups, for example industrial and domestic customers. However Ramsey pricing, which provides for mark-up on marginal cost for classes of users characterized by lower demand elasticity, poses problems of equity in the water sector, as the price elasticity of low income users is lower than the one of higher income residential (Jansen and Schulz 2006) or industrial users.

The options for the design of tariff structures and of subsidy mechanisms have been considered in different studies on developing countries, particularly focusing on their distributional impact (Boland and Whittington 2000, Chisari et al. 2003, McIntosh 2003).

IBT structures were first designed in industrialized countries to assist poor households and they have later gained popularity also in developing countries. According to Boland and Whittington (1998), the most common arguments in support of IBT structures are:

- Social Concerns, affordability: it is claimed that IBTs promote equity because they force rich households to cross-subsidize poor households. In fact, wealthy households will use more water than poor households, as water is a normal good (as opposed to inferior goods) and its use is expected to increase with income (watering gardens, water-using appliances, washing cars). The low price of the first block allows poor households to obtain a sufficient quantity of water for their basic needs at a low monthly cost, while rich households pay a higher average price for water because a greater percentage of their water use falls into blocks associated with higher rates.
- Environmental sustainability: IBTs are good because the price associated with the highest block can be made punishingly high and thus discourage or stop wasteful water uses. It is thus felt that IBTs promote water conservation and sustainable water use.
- Economic sustainability: IBTs are needed to implement marginal cost pricing principles, with the growing rates associated to each block reflecting rising marginal costs of municipal water supply.

Reviewing these arguments with reference to cities in developing countries the same authors (Boland and Whittington 1998) identify some problems and limitations.

- In many cities in developing countries many poor households do not have private metered connections to the water distribution system, and thus are not in a position to be helped by IBTs. Furthermore the poor often get water through shared connections, neighbours who have a private connection, or resellers. With more households sharing the same connection, under an IBT regime, water use by the group quickly exceeds the volume of the first block, so that the poor pay higher average prices than the rich.
- The idea that IBT can discourage waste of water relies on the assumption that large users of water are the most likely to engage in "wasteful" use, which is not always true.
- Under IBTs different users simultaneously pay different prices for the delivery of water, out of which at most one price can be equal to the marginal cost. Moreover the idea that increasing block rates reflect the trend of marginal costs is questionable. As discussed above marginal costs can rise with increased aggregate use or can remain constant or decline, as

well, depending upon the spare capacity of the system and on the existence of diseconomies of scale associated with the development of new sources.

1.5 Forms of regulation

The need for economic regulation is due to the existence of significant market failures resulting from economies of scale and scope in production, from information imperfections in market transactions, from the existence of incomplete markets and externalities, and from income and wealth distribution (Amann, 2006).

Regulation should be an independent activity but it does not always imply the existence of a dedicated regulatory body. In the French water industry and in former French colonies, *Regulation by Contract* is common. This means that long-term contracts between the service provider and a state owned entity regulate water services.

Regulation gained momentum with the privatization wave of the end of the twentieth century but it is not limited to the regulation of private sector operators, as it is considered necessary even in settings where water supply is public, particularly when utilities are corporatized and managed according to commercial principles. Regulation is also consistent with a notion of governance, intended as a technique of "government beyond the state" (Swyngedouw 2005), involving market actors and civil society (Lobina 2012).

Water pricing is among the key issues for water supply regulation, as the pricing variable is crosscutting to most of the priorities addressed by regulation and critical to the access by poor consumers in developing countries.

Regulation can also address issues related with service quality, environmental protection, infrastructure development, and access to water services by the poor. This is usually done through Command and Control regulation. As monopoly operator has incentives to increase profits against service quality, regulators can introduce quality standards, quality monitoring procedures and the related penalties. Environmental regulation also includes environmental and safety standards, compliance monitoring, and penalties or rewards. This happens for example with the control over wastewater pollution and network leakages, even if, often, the utility regulator does not have direct responsibility for environmental regulation which is covered by different institutions. This makes coordination critical to the achievement of environmental goals and for Integrated Water Resources Management (IWRM). Infrastructure development is also a key area for regulators, particularly when it is intended to reach the unserved population and the poor. In some cases to reach these targets, the regulator may want the operator to provide services that are not commercially viable, through subsidies designed to assist the poor.

The broad coverage of fields which can be regulated reflects the aim of achieving the social welfare goals set down by the governments for the regulatory authority. Welfare is to be intended as the aggregate benefit that infrastructure services provide, including benefits to consumers (measured as net consumer surplus), benefits to operators, and externalities. Furthermore distributional issues in regulation are important and address how different stakeholder groups are affected differently by the solutions adopted for the provision of infrastructure services. Regulation explicitly targeting poor people and aiming at poverty reduction and redistribution is referred to as pro-poor regulation. Pro-poor objectives, quality and environmental standards are often covered by Command and Control Regulation which defines what is illegal and provides the quality standards and targets that operators must comply with, jointly with the sanctions that may result from non-compliance.

Other forms of regulation instead try to simulate some competitive pressure to provide incentives to the operators. According to Jamison and Berg (2008), policy makers or regulators can try to expose operators to competitive pressures, in three different ways:

1. competition in the market: multiple operators compete in the market for customers;
2. competition for the market: operators compete for the market by bidding for the right to be a service provider;
3. competition between markets: operators in different markets compete by comparing their efficiency and effectiveness and the best performers are rewarded.

Competition in the market is difficult to introduce in the water supply sector, due to problems related to water quality and vertical integration/separation.

Quality problems arise as the cost of piped networks makes duplication inefficient, while the possibility that different competitors sharing the same infrastructure, as it is sometimes the case for telecommunication infrastructures is not easily feasible. As a matter of fact, introducing multiple water suppliers in the same distribution network would create uncertainty about the origin of water in the network and the related liability in case of health problems (Bisshop 2001). This would in turn provide powerful incentive to free-riding by operators. Moreover, there are possible losses of economies of scope and transactional economies (coordination costs, i.e., to cost reflecting the design, the negotiation and the enforcement of contracts between buyers and sellers) associated with the use of intermediate product markets (Garcia et al. 2007). Furthermore it was observed that separation might reduce the institutional control over water abstraction and jeopardize the application of the Integrated Water Resource Management principles developed by the Dublin conference in 1992 (Lobina and Hall 2008). The feasibility of vertical separation, sometimes called unbundling, of different stages of the water supply industry is instead more common, provided that one operator only is present at each stage. It is obtained by separating water production (catchment, pumping, storage,…) from water distribution.

1.5.1 Competition for the market and the Private Public Partnership options

Competition for the market is usually achieved through the launch of a competitive bidding process, which is typically a consequence of the decision to privatize some water supply services. These competitive processes can result in different types of contract, which are briefly introduced below, jointly with the discussion of the respective responsibilities of public and private sector.

- Service contracts: short-term agreements whereby a private contractor takes responsibility for a specific task, such as installing meters, repairing pipes or collecting bills. Payment usually consists in a fixed or per-unit fee agreed in advance, but it can also include performance incentives. This type of contract with respect to the other ones allocates the least responsibility to the private sector, as it is only responsible for specific tasks. However, sometimes service contracts have a wider scope (see Chapter 3).
- Management contracts: the contractor has the responsibility for the operation and maintenance of the water system. The public sector retains responsibility for investment and expansion and, sometimes, for some management aspects (e.g. billing, revenue collection). Payment from the contracting authority to the contractor can be fixed or performance-related.
- Lease/*Affermage* contracts: in these contracts the contractor has the responsibility for operation and maintenance but also some responsibilities for commercial functions and revenue collection. In the case of lease, the operator pays to the contracting authority a fee, which tends to be fixed, bearing the risks that operating costs plus the fee might not be proportioned to the actual collection. In the case of *affermage* the contracting authority pays a fee to the operator and bears the risk that the revenues collected and transferred by the operator might not be proportioned to the fee.
- Concession contract: in this case, the private contractor manages the whole utility at its own commercial risk and it is also in charge of maintenance and expansion of the system. The assets are transferred back to the state at the end of the contract if it is not renewed. The role of the public sector in concession contracts is predominantly regulatory.
- BOT (Build, Operate, Transfer) contracts: the difference between these contracts and concession contracts is that they are usually used for "greenfield" projects (water and sewage treatment plants, rather than water supply systems which are rarely built from scratch). The contractor then manages the infrastructure and the government purchases the

supply or the service produced. At the end of the contract, the assets are usually transferred back to the government, sometimes at a pre-determined fee.

- Divestiture: under this contract, the government transfers the water business to the private company, including the assets (infrastructure), on a permanent basis and it only maintains a regulatory role. It should be noticed that, once a divestiture initiative is finalized, there is no longer any competition and it is even difficult to revive it.

The table below summarizes the main features of these types of contracts, focusing on the allocation of the different responsibilities among public and private actors.

Table 1.2: Allocation of key responsibilities for private participation options.

	Service Contract	Management contract	Affermage	Lease	Concession	BOT	Divestiture
Asset ownership	Public	Public	Public	Public	Public	Private/ public	Private
Capital investment	Public	Public	Public	Public	Private	Private	Private
Commercial risk	Public	Public	Shared	Shared	Private	Private	Private
Operations/ maintenance	Private/ public	Private	Private	Private	Private	Private	Private
Contract duration (years)	1–3	3–5	8–15	8–15	25–30	20–30	Indefinite

Source: Budds and McGranahan 2003 from Stottman 2000

While Public Private Partnerships (PPPs) result from the recognition of some degree of public governance failure, it is important to notice that their regulation poses high level demands of skills to the public sector and potential problems of integrity. This will be further discussed in 1.6.3. Moreover, Private Sector Involvement in developing countries and in Sub Saharan Africa has proved to be more challenging than expected, because few private actors were willing to participate and invest and many contracts were subject to disputes (Marin 2009). More than 70% of the management and lease contracts implemented in SSA water sector in the last few decades were cancelled or not renewed (Dagdeviren and Robertson 2013).

The third chapter will focus on PPPs and particularly on management contracts and service contracts which do not transfer investment and commercial risk to the private partners.

1.5.2 Competition between markets: incentive regulation

Incentive regulation is generally implemented by controlling the overall price level of the operator, or through benchmarking regulation. Once the desired base level of price has been identified, by calculating operational costs or including capital costs in the form of average cost or in the form of Long Run Average Incremental Cost, there are four basic schemes to adjust and regulate the price that the operator can charge in the regulatory period, namely:

- rate of return regulation;

- price cap regulation;
- revenue cap regulation;
- yardstick regulation.

According to Rate-of-return regulation, monopoly firms are required to charge the price that would prevail in a competitive market, calculated on the basis of the efficient production costs and a pre-determined rate of return on capital. The resulting formula for total revenues is:

$$\text{Total revenues} = \text{Total Costs} + r * \text{invested capital} \qquad (1.3)$$

where *r* is a convenient rate of return, whose value is based on competitive market rates. The notion of competition between markets is based on the idea of taking a rate from other markets. Averch and Johnson (1962) however demonstrated how regulation of a firm's rate of return could lead to incentives to over-invest, while later studies highlighted other potential inefficiencies that could be introduced by rate-of-return regulation, like higher operating costs (e.g. Bailey, 1973), as the system does not provide incentives to control them.

Price-cap regulation adjusts the operator's prices according to a price cap index that reflects the overall rate of inflation in the economy and the ability of the operator to gain efficiencies relative to the average firm in the economy. The rate of inflation is usually measured by a Retail Price Index (RPI), or in some cases by an index reflecting the operator's inputs prices. The Price Cap is the rate to be applied to the price of the previous regulatory period and, in the water industry, its formula is:

$$\text{Price Cap} = \text{RPI} - X \qquad (1.4)$$

where X represents the expected efficiency savings. The Price Cap system is intended to provide incentives for efficiency savings, as any savings above the predicted rate X can be passed on to shareholders, at least until the price caps are next reviewed (usually every five years). A key part of the system is that the rate X is based not only on the firm's past performance, but on the performance of other firms in the industry: X is intended to introduce pressure to achieve efficiency gains, as it is the difference between the operator and the average firm in the economy, after accounting for inflation in input prices.

A value K, based on capital investment requirements can be added, taking it from other methodologies (like benchmarking regulation), this resulting in a mixed regulatory form. In this case the formula will be:

$$\text{Price Cap} = \text{RPI} - X + K \qquad (1.5)$$

In practice, the distinction between price-cap and rate-of-return regulation may be lost, as regulators can implicitly base their price limit determinations on the acceptable real rates of return on capital employed.

Revenue Cap regulation is a system for setting the prices charged by regulated monopolies limiting the variation of total revenue in a given period. As for price-cap regulation, the Revenue Cap system uses a rate:

$$\text{Revenue Cap} = \text{RPI} - X \qquad (1.6)$$

The option to apply the rate to revenues, rather than to prices, means that the regulated enterprise does not face any quantity risk. This may be appropriate in cases where the quantity demanded is largely outside the control of the regulated firm, and where costs may be insensitive to short-term variations in quantity demanded.

Competition between markets is also created through yardstick, or benchmarking, which compares operators working in separate markets, through general performance measures, like the cost per cubic meter of water. Benchmarking can be used to regulate overall price levels, but also to regulate items like service quality and network expansion. Jamison and Berg (2008) note that benchmarking can also be an input into rate of return, price cap, or revenue cap regulation rather than as method of incentive regulation that could be used by itself or it can be an element of hybrid, or mixed, regulation schemes.

Benchmarking regulation is often be used to create a climate of competition among different utilities under the same regulatory body. This is made possible by the publication of annual reports with the ranking of utilities according to the benchmarking indicators of performance, or by linking such performances to awards and bonuses for the staff and the executive management of the utilities.

1.6 Challenges for water supply regulation

Before entering in the specific challenges faced by regulators and sometimes limiting the social benefits from the regulatory activity, it is worth to notice that regulation has its own costs. They can be classified as follows:

- costs of directly administering the regulatory system by the government;
- compliance costs of regulation, which are borne by consumers and producers to conform with the regulations or to evade them (Guasch and Hahn 1999);
- transaction costs, related with the existence of a public regulatory body which is separated from the service provider, regardless the public or private ownership of the regulated service provider.

Moreover, regulation arises to correct market imperfections but regulation itself is prone to a number of imperfections. The next paragraphs will focus on some relevant issues addressed by economic literature about water supply regulation, particularly referring to developing countries: incomplete information, alternative providers, institutional capacity and balances of power.

1.6.1 Incomplete information

Information asymmetries, often analyzed in the terms of the principal-agent theory (Meckling 1976), may contribute to imperfect regulation. The regulator and the regulated can be expected to have different levels of information about costs, revenues and demand.

Since it is unlikely that the regulator will receive all the information required to regulate optimally, the results of regulation, in terms of outputs and prices, are usually considered by economists to be a second best when compared to those of a perfectly competitive market.

Information asymmetries have implications on the option for private or public water services provision (Sappington and Stiglitz 1987). On the one hand, according to Shapiro and Willig (1990) public ownership provides more information to regulators than private ownership, thus reducing the information asymmetries and the transaction costs of regulation. On the other hand, public ownership might provide inadequate incentives to maximize economic efficiency (Hayek 1945), for example due to hold up (Dagdeviren and Robertson 2013) or to moral hazard by managers.

The emphasis on welfare improving regulation for developing countries, makes important to consider the problem of incomplete information of regulators, not only, as it was done above, in terms of information asymmetries in relation to the regulated entity, but also in terms of absolute lack of information.

Often regulators do not have sufficient information about the location, the dimension and the actual access to water services by the poorest users. Reliable information is critical to economic regulation (Armstrong 1994) and pro-poor regulation should be based on a deep understanding of the potential customers of each utility, of the existing service providers (including alternative provides whose role will be discussed in 1.6.2), and of the features of the demand expressed by different users groups, discussed in 1.3.

Statistical information on water services is usually collected by the governments and development agencies to monitor the achievement of the Millennium Development Goals (MDG), so that there is a focus on coverage[1] and access, without qualifying the type and level of the service provided to the population. Census and poverty data are rarely linked to these monitoring exercises and are prone to significant biases, often excluding informal settlements and peri-urban areas (Gerlach and Franceys, 2010).

[1]Coverage refers to the number of users reached by water utilities or to their proportion over the total users basin supposed to be served.

Furthermore information about the full cost of water services to the various user groups can fail to account for additional expenditures faced by household which affect the price that can be charged. These were already introduced in 1.3 and are, for example, the costs for household level storage of water resulting from intermittent service, the costs of other coping mechanisms or the costs and opportunity costs of reaching water sources.

Finally, shared connections and above-average household sizes are very common among poor users and can jeopardize the functioning of "lifeline" tariffs (Gerlach and Franceys, 2009) if proper information about these arrangements is not available to regulators. There is also a lack of data on prices charged by alternative non-utility providers and their seasonal fluctuations.

1.6.2 Alternative providers

As already introduced in 1.3, piped water for most developing countries do not represent the only source of water for the reference population of the utilities.

Unconnected households rely on a wide range of alternative providers, who are often unregulated and illegal. Even households which are connected often rely on alternative sources to cope with rationing and shortages or for water uses other than drinking or cooking.

These alternative sources are provided by a wide range of small scale formal and informal actors. They are private, sometimes cooperative, actors purchasing utility water or producing bulk water and providing it, thought a variety of means (kiosks, micro networks, water carts) to households in the informal and poor neighbourhoods of African cities. Alternatives to utility water however also include direct collection from streams and shallow wells in rural and peri-urban contexts.

According to most authors (Bakker 2008, Sansom 2006, Gerlach and Franceys 2010), there is the need to extend the scope of regulatory oversight to include this variety of service arrangements that operate alongside formal operators and water utilities, and some good practices are already being developed in the sector. The idea is that, if regulators were able to deal with independent, small scale and informal providers, the positive potential of these actors for extending the access to water services could be enjoyed, while limiting the related affordability, public health and environmental risks and avoiding monopoly rents.

Regulators, however, often lack information about the parallel/secondary water markets which serve the same population targeted by the formal utilities and which can account for a share of 80% or more of the population (Collignon and Vèzina 2000), while their turnover can also be considerable.

The alternative water providers often, either knowingly or inadvertently, infringe existing regulations or exploit loopholes in the law (Gerlach and Franceys 2010). This might introduce some risks both on environment and public health, since they might cause over-abstraction of ground water or seawater intrusion in the water tables, or, in the absence of water quality controls, they could provide unsafe water to users.

Another concern about alternative providers and economic regulation is related with the comparatively high water prices charged. As seen above, on the demand side, pricing differentials were often claimed to demonstrate that willingness to pay by poor water users in developing countries is higher than the actual utilities tariffs, thus calling for price increases.

On the supply side such price differentials are related with the scale of operation of alternative providers, with the type of water source they rely on, and with the model of water distribution, which have an impact on operating costs. Furthermore, corruption and anticompetitive behaviour can be related with vested interests, like government income derived from abstraction fees and involvement of bureaucrats and utility staff in lucrative vending businesses and installation of illegal connections.

On the contrary regulatory risk can also affect alternative providers, for instance where existing regulations give a competitive advantage to formal, utility water providers because they have exclusivity rights, despite their inability to cover large proportions of the target population. The main recommendations available about how to address these challenges through economic regulation are reviewed below.

Considering that networked service provision by a city-wide water utility is the most economic option for serving urban areas, Gerlach and Franceys (2010) observe that regulatory mechanisms need to be designed on the understanding that alternative providers, while providing a critical service in many low-income settings, will be gradually replaced by utility water supply. When cities attract new residents faster than the utility can upgrade and extend service infrastructure, contracted resellers and licensed independent providers could be the solution to cover informal settlements that are difficult to be served by the utility. The same authors thus call for an enabling legal framework to allow and encourage cooperative arrangements between alternative providers and utilities, recognizing that in many cases the alternative providers have important "pro-poor service skills" and recognizing the need of protecting their investments. In order to enjoy the potential of alternative providers, the regulatory framework should also consider the capacity of alternative providers to answer the needs of poor users through minimum service levels. As a matter of fact, standards usually follow internationally accepted engineering standards and might set rigid and unrealistic targets relegating alternative providers to the informal sector.

The formalization of alternative water providers obviously has a regulatory cost, which is likely to be high due to the lack of any centralization of these actors. For this reason, the most cost effective solution is that they should be regulated by the formal utilities already in charge of the areas where alternative providers operate. In this way the utility remains formally liable for the service provided subcontracts the operators. Informal operators can also be monitored by delegating some monitoring functions to consumer groups (Gerlach and Franceys, 2010).

Formal Private Sector Involvement initiatives in SSA often proved to be challenging and unsuitable. The ideological rehabilitation of private small scale informal providers should not be used to revive the myth of healthy competition in the water sector (Ahlers et al. 2013) and the ideal of smart entrepreneurs and welfare maximizing market allocation. Therefore, while recognition and regulation is necessary and positive for access, for public health reasons and to avoid overpricing, ideological positions should be taken more carefully.

1.6.3 Institutional capacity and balances of power

According to the definitions of Jalilian et al. (2006), pp. 15-16: "*accountability requires the regulatory agencies to be accountable for the consequences of their actions, to operate within their legal powers, and to observe the rules of due process when arriving at their decisions (...), transparency relates to regulatory decisions being reached in a way that is revealed to the interested parties*" and consistency relates to the safeguard of public confidence in a regulatory system and reduction of uncertainty for investors and operators.

The capacity of the public authority to put in place strong regulatory institutions is critical to market functioning. An economy with a developed institutional capacity is more likely to design and implement effective regulation, also contributing to poverty reduction.

These concepts can also be described in terms of good governance, which comprises predictable and enlightened policy making, a bureaucracy oriented by professional ethos, an accountable government; a strong civil society participating in public affairs, and the primate of the rule of law (World Bank 1997).

As a matter of fact, both the process and the outcomes of a regulatory regime depend upon the specific institutional context of an economy, as reflected in formal and informal rules of economic transacting (North 1990).

Important considerations about the role of the public bodies in regulation are related to the concepts of regulatory and political capture respectively. According to the public choice theory, as individuals are self-interested (both in and out of the public arena), also the regulation in place will be the result of the relationships between different interest groups (Buchanan 1972, Baldwin and

Cave1999) and it can be biased in favour of particular interests. This is referred to as regulatory capture and is sometimes explained by the concentration of regulatory benefits and diffusion of regulatory costs, which enhances the power of lobbying groups seeking rents (Stigler 1971, Peltzman 1976, Reagan 1987). Political capture, instead, refers to a situation where the regulatory goals are distorted to pursue short term political ends, becoming a tool of self-interest within government elite (Stiglitz 1998).

These considerations pose an important problem of “institution building”. The model of economic regulation as a purely technocratic institution concerned with the correction of market failure and maximization of consumer welfare is being challenged in the European context (Finger and Varone 2006) and it is even less applicable in developing economies (Gerlach and Franceys 2010).

In developing countries, economic regulation was the latest in a series of attempts by governments and their advisors to accelerate universal and sustainable provision of infrastructure services (Gerlach and Franceys 2010). However, there was a certain overreliance on conceptual frameworks borrowed from western experiences. This limited the theoretical understanding of the specific challenges of regulation in developing countries (Laffont 2005) and particularly the integration of regulation into wider poverty reduction strategies. As the creation of regulatory institutions usually occurred within broader processes of water services privatization or commercialization, literature tends to concentrate on the regulation of privatized utilities. Nonetheless, as it is increasingly recognized that privatization was unable to deliver the expected benefits for the urban poor (Marin 2009), there is a growing interest and awareness in appropriate regulatory frameworks as drivers to achieve basic water service provision for the poor (Furlong 2010).

It was often noticed that “institution building”, including building an accountable, transparent and consistent regulatory regime, is one of the most difficult problems faced by developing countries at present (Kirkpatrick and Parker 2004).

Estache and Kouassi (2002) analyzed the determinants of the efficiency levels reached by 21 African water utilities, estimating a production frontier for the sector in Africa in the period 1995-197. The results showed that the institutional capacity of the country and its governance are significant drivers of performance for firms.

Regulatory institutions are a relatively new in the institutional structures of developing countries, but the limited evidence from researches that are available, suggests that a number of regulatory failures already occurred (Amman 2006), also as a consequence of structural weaknesses in institutional capacity.

In developing countries the newly created regulatory bodies are often staffed by employees from the former public utility, usually deemed to be inefficient. Therefore, it is not clear why they should be better in regulating the system, than in running it (Budds and McGranahan 2003), unless the new context, duties and leadership can improve their performances.

Private sector participation also brings in new challenges, since national and local governments are likely to be less experienced than their private counterparts in negotiating contracts.

On the one hand, as it was discussed above, it may be a problem when water and sanitation utilities are manipulated to serve short-term political interests (political capture). On the other hand, as noted by Budds and McGranahan (2003) it is also a problem when the opposite happens. This can also be related with the imbalance of power that can be frequently observed when indebted governments negotiate with international financial institutions and multinational water companies. This makes difficult for the local regulator to play its role effectively. Examples of imbalances of power can also be found in the bidding procedures and in the following implementation of contracts. There is usually a two steps procedure, where shortlisted private companies, qualified at the first step, make their own assessments of the local context (e.g. state of the infrastructures, current tariffs, extent of coverage, nature of government) and then submit bids. The design of the procedure and the criteria conveyed in its guidelines are critical to the success of the implementation phase. However, bids rarely focus specifically on addressing the obstacles to improving services in low-income areas, due to the need to be attractive to potential bidders, otherwise no bids would be received (Budds and McGranahan 2003).

The relative weakness of the contracting authorities in developing countries, jointly with the competition which characterizes the procedure can also introduce an incentive for bidding companies to underestimate the costs, thus renegotiating contracts during implementation, after a more complete assessment, as it was the case for many contracts in developing countries.

The particular problems raised by private monopolies, jointly with the consideration that regulation should not be restricted to privately operated utilities but should be developed also for public utilities, raises according to Budds and McGranahan (2003) important issues related to the time sequence of the privatization and regulation initiatives. If a good regulatory environment is necessary for privatization to succeed, the logic priority should be given to regulatory improvement, while privatization could be introduced if and when it can proceed smoothly and with local support and management capacity.

Last, privatization initiatives could lead to a further weakening of the institutional capacities, as the transfer of functions to the private sector operator can result in the de-skilling (Bayliss 2009) of the public sector. The issue of the interaction between private sector participation and institutional capacities of water utilities is among the ones addressed in Chapter 3.

1.7 References

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2 Cost recovery and access to drinking water in Sub Saharan Africa: incentives to achieve the Millennium Development Goals

2.1 Introduction

In September 2000, building upon a decade of major United Nations (UN) conferences and summits, world leaders came together at UN Headquarters in New York to adopt the United Nations Millennium Declaration (Resolution adopted by the General Assembly, A/RES/55/2), committing their nations to a new global partnership to reduce extreme poverty and setting out a series of time-bound targets - with a deadline in 2015 - that have become known as the Millennium Development Goals (MDG).

The goal number 7 was "Ensure environmental sustainability" and it includes the Target 7.C that was to "halve, by 2015, the proportion of the population without sustainable access to safe drinking water and basic sanitation".

The water MDG is dramatically off track in Sub Saharan Africa, with only 64% of the population covered in 2012 instead of the expected 77.5% (WHO and UNICEF 2014) and with these poor performances driven by urban areas, where the water supply coverage through household connections declined while the access through other improved sources, including *non utility* water, hardly compensated for that. This calls for a reconsideration of the policies implemented in the sector to promote commercialization and financial efficiency by water utilities. As argued by Mehta (2014) p. 68 "*even though policy rhetoric may be about rights and equity, in practice (…) considerations of utility and efficiency persist which may not always have the interests of the marginalized upfront*".

After a phase centered on the priority of privatization, in the last 10 years the sector policies developed into a new agenda, which is still focused on promoting private sector involvement, but is now aimed at improving the devices to be adopted by states, municipalities and State Owned water Enterprises (SOE) to become more efficient by mimicking the private sector, in line with the New Public Management approach.[2] Some key priorities of this new approach are SOE corporatization, performance contracts with incentives and penalties, rate of return policy (Furlong 2010, Banerjee and Morella 2011).

These priorities are translated at the operational level in a number of requirements that utilities are urged to comply with. These requirements include, among others, the increase of cost

[2] See for example Schwartz (2008).

recovery and average tariff levels, the control of costs and are mainly related with financial performances and efficiency.

Financial health alone, however, is not enough to ensure that utilities have the investment capacity that is necessary to bridge the funding gap of the African water supply sector. From the 1980s studies on contingent valuation and willingness to pay (among others, Whittington et al. 1994) conducted on developing countries fuelled some enthusiasm on the potential for full or capital cost recovery. However, once tariff rise proved to be politically more challenging than expected and efficiency gains more limited, the policy debate moved the attention from a call for full costs recovery through tariffs to the concept of sustainable cost recovery, first introduced by the Camdessus report (Winpenny 2003). The latter allows for a mix of Tariffs, Taxes and Transfers (TTT), recognizing the importance of affordability. The possible criteria for spreading the cost of water services can, thus, be viewed along a continuum between endogenous and exogenous solutions (OECD 2010), with purely endogenous solutions fully relying on users for cost recovery and purely exogenous solutions transferring all the costs to external actors (people located elsewhere, future generations).

Overemphasizing financial performances can be misleading for utility management and political decision makers due to the trade-offs (OECD, 2010) which characterize the relationship between social, environmental and financial sustainability goals in the water sector.

Achieving a balance between financial and social objectives is also a key challenge for the regulators of water services, regardless the nature of the regulated provider (public monopoly, conventional private sector, informal private sector), as discussed by Gerlach and Franceys (2010).[3]

The incentive system associated with these performance measures can be an explicit performance contract (the SOE enterprise is contracted by the public authority in charge) or can be related with the conditional access to soft loans and other forms of financing from development agencies.

Urban water supply is generally considered to be more commercially viable then other services, so that, in Africa it was often separated from unprofitable elements, such as sanitation and rural water supply and cost recovery targets are particularly demanding for urban utilities, which are the object of the present study[4].

[3] Out of eleven case studies covered by the study by Gerlach and Franceys four are from Sub Saharan Africa.

[4] The utilities included in the sample fall in the following classes: 1) national level utilities with competence on all or some of the country major urban centers (and the corresponding peri-urban areas), 2) regional/state utilities with competence on the head town or on the main centers of the region/federal state 3) municipal level utilities with competence over one municipality . The focus on urban water supply indeed is not the result of a selection of utilities, but depends on the organization of African water supply sector, which is characterized by the fact that most rural areas are unserved or served by community managed water schemes and through decentralized solutions which fail to be registered and provide data to international level benchmarking and data collection initiatives.

The need to rely only on tariffs however can provide adverse incentives to the extension of networks to poorer areas, as the poor can be perceived by both private operators and corporatized utilities, as an unprofitable market.

The present analysis aims at verifying if cost recovery indicators, are suitable to design a proper structure of incentives that could push utilities to achieve the main goal of African water utilities, defined by the target 7.C in MDG. The achievement of the MDG was more challenging in Africa than anywhere else in the world due to rapid urbanization and present low coverage rates. This study contributes to the understanding of the most appropriate weight of the component tariffs in the TTT mix, when access challenges are to be addressed. The effect of cost recovery levels on coverage rates will be thus assessed and discussed in order to verify if the incentive structure based on them has a significant effect on the results of utilities in increasing their access rates.

The chapter is organized as follows. Section 2.2 contains a literature review and presents the hypothesis to be tested. In Section 2.3 the data set used is described. Section 2.4 provides empirical results, while Section 2.5 contains some concluding remarks, including those pertaining to policy implications.

2.2 Literature review and hypothesis

2.2.1 Literature review

The present literature review focuses on studies investigating the relation between cost recovery and changes in coverage, including both qualitative and quantitative studies. Particular attention is given to studies about countries which are well represented in the sample (see Description of the dataset) and to studies about corporatized utilities, regardless the involvement of private contractors.

Dagdeviren (2008) focuses on the commercialization of urban water services in Zambia demonstrating the tension between cost recovery and service extension when water sector reforms combine low level of public investment with price increases. According to the author, Zambia typifies other low-income economies and the aspirations for cost recovery in water supply services can be a means to increase the proportion of the population with access to safe water, but with an inappropriate policy mix, can also lead to the opposite result of declining access rates.

Herrera and Post (2014) considers 35 countries which engaged in corporatization and inherent cost recovery policies. The author finds that cost recovery encountered strong resistances by the population and by local politicians. These resistances, thanks to the decentralization policies implemented jointly with corporatization, challenged the success of the reform. The author argues that the relation between cost recovery and investments in infrastructure (necessary to provide access to water) was not properly explained to the population, and resulted in resistances. The assessment of the strength and features of this relation instead remains outside the scope of the work, while it is more directly addressed in another contribution from the same author (Herrera 2014). In this study the authors present three case studies in Mexico municipalities which adopted cost recovery policies. Cost recovery policies are found to favor rich cities with strong industrial and middle class bases and politicians who cater to these constituent groups, as fiscal self-sufficiency requires a customer base that can generate sufficient revenue to finance service improvements. In poor regions instead, improving service in urban centers with revenues from consumer fees is challenging. Bakker et al. (2008) focus on incentives to analyze the institutional dimensions of urban water supply provision to poor households in Jakarta. Based on both quantitative and qualitative evidence they identify some governance failures which created disincentives both for utilities to connect poor households and for poor households to get connected. Cost recovery requirements were identified among the drivers of governance failure: indebtedness provided adverse incentives to the operator to connect loss-making poor households, while poor customers preferred alternative water sources, due to the high total cost of utility water, when both volumetric and fixed charges are considered.

Next, Ballance and Tremolét (2005) compare in a narrative way the performances of utilities of 7 SSA countries, engaged in private sector participation or SOE corporatization (public performance contracts and commercialization) between the end of the 1990s and the early 2000s. They assess technical and financial performances, with the first conceptualized, among others, in terms of coverage rates. The authors find some correlation between financial indicators and technical performance, but they also point out the need to be cautious, mentioning two country cases where technical and financial performance are consistent (high tariff and good performances in Senegal and Burkina Faso) and one where they are not (low tariffs and good performances in Tanzania). Anyway, the study does not focus on access as such and coverage rates is only one of the measures of technical performances used (other measures are OPEX[5] per connection per year, collection rate and staff per 1000 connections).

Coming to more quantitative studies, Whittington et al. (1991) in his seminal work about willingness to pay presents a case study of water vending in a big town of Nigeria. He relates the willingness of households to pay for improved water services with water supply planning and investment. Willingness to pay is taken from the rates charged by organized water vendors, also

[5] OPEX stands for OPerational EXpenditures and it is used as a synonymous of Operation and Maintenance Costs (O&M).

accounting for the mark ups charged by households and businesses equipped with water storage facilities and reselling the water to the poor. He concludes that, on an annual basis, households are already paying water vendors over twice the operation and maintenance costs of a piped distribution system. As it will be seen below, this approximates full capital cost involved (GWI 2004), allowing some optimism about the possibility of financing infrastructural investments form users fees.

The study by Estache and Kouassi (2002) is focused on African water utilities analyzing a panel of 21 utilities from 1995 to 1997. They find that there is an enormous space for efficiency gains which could be translated in increased access. Corruption is found to be positively linked with inefficiency, while governance and privatization are negatively linked with inefficiency.

Similarly, Mbuvi et al. (2012) present a productivity analysis of efficiency and effectiveness of African drinking water urban utilities, based on data from 51 utilities from 2006 WOP -Africa self-assessment. Utilities' technical efficiency (human resource and infrastructural dotation are considered as inputs and volume of water and persons served as outputs) and effectiveness (including water coverage but also indicators like per capita consumption, number of connections and continuity) are estimated. Authors argue that utilities face technical inefficiency rather than ineffectiveness challenges and that they do not need any additional inputs to provide water supply services to all the population. Correlation between utilities' efficiency and their water coverage (only) is not reported at all, and if taken together with total water sales (which are not in line with MDG definition of access being core of the present analysis), is below 0.3. Thus, based on the results of the study by Mbuvi et al. (2012), one can conclude that efficiency of water utilities in Africa is in fact limited and highly heterogeneous, calling for independent regulation and necessity to improve management. However, one cannot make a solid conclusion on whether there is no ineffectiveness problem resulting from incentive conflict many water utilities face in Sub Saharan Africa.

Banerjee et al. (2008) use data from the African Infrastructure Knowledge Program datasets and from the MDG Joint Monitoring Programme producing some descriptive statistics. This study focuses on efficiency and compliance to the reform requirements. A relevant finding which is presented in this study is that expanding coverage of water services is correlated with efficiently operated utilities and functioning governance, while the relationship between coverage and public spending is tenuous.

Summarizing, the quantitative scientific literature reviewed (Wittington et al. 1991, Estache and Kouassi 2002, Mbuvi et al. 2012), is optimistic about the relation between financial performances and access, but authors tend to focus more on the potential to improve the first (high willingness to pay, potential efficiency gains), then on the translation of financial results into access. The technical reports considered (Ballance and Trèmolet 2005, Banerjee et al. 2008) find some correlation between financial and technical performances, and between efficiency and access. However, their definitions of the terms, while including cost recovery and access is not strictly corresponding to them. Qualitative studies (Dagdeviren 2008, Herrera 2014, Bakker et al. 2008), point o the challenges which can prevent cost recovery and its translation into access, also focusing on incentives posed on the actors.

Overall, based on the literature, it is necessary to recognize that the relation between financial performances and access is complex and there is a paucity of empirical studies which specify the exact features of the relation. This would be useful to identify some thresholds to be taken as a reference when setting targets for financial performances to avoid perverse effects on access.

2.2.2 Hypothesis: financial and water access

With reference to internal and external funding, in the late 2000s, the WB recognized that privatization policies were not going to bring in the necessary investment finance for the African water supply sector, for its high risk and low profitability (investments were close to zero according to Foster and Briceno Garmendia (2010). From this moment, the private sector involvement was promoted as a mean to improve the efficiency of utilities (with short management contracts, without investment risks on the private side) and, the other way round, efficiency gains were pursued as a mean to boost the interest of the private actors to the sector.

This focus on efficiency led to an even increased emphasis on the financial performances of public utilities, whose relation with infrastructural investment can be seen in three ways:

1. The operational margins will be reinvested, or will allow the utilities to obtain the necessary loans.
2. The financial sustainability of utility operations will provide a sound basis for investments from grant and fiscal finance because of the expectation that, also with an enlarged user base, the utility will still ensure the recovery of operational costs.
3. There is a donors' favorable bias toward utilities which comply with the performance and efficiency requirements.

Given the proportions between operational margins and capital costs of infrastructural investment, the first assumption would require an unrealistically long term commitment of investors or a similarly unlike availability of long term loans. As a matter of fact, similar commitments can be supported only by a strong political will and not by the expectation of commercial returns. This is due to the time horizon of infrastructural investments which usually exceeds 20 years. This is also confirmed by the WB recommendation (Banerjee and Morella 2011 and Africon 2008) to estimate annual per capita Operation and Maintenance Cost (O&M cost) for Africa at 3% of per capita cost of capital for network assets. This recommendation roughly means that the capital premium proposed by GWI[6] should lead to the recovery of capital costs, not to mention of profits, in 33 years, which is likely to be beyond the time horizon of private investors and commercial finance.

While levels of revenues consistent with the level of O&M costs can encourage investments to increase the coverage, high levels of cost recovery,[7] tending toward full capital recovery, are unlikely to attract additional commercial finance. Moreover, as already argued above, the pursuit of financial returns can divert resources and attention from the priority of serving the poor. Capital cost recovery tariffs, or Full Cost Recovery are recognized to be not affordable for 60% of Sub Saharan Africa households (Banerjee et al. 2011). The thresholds of cost recovery recommended in the available literature are as follows:

- the Global Water Intelligence benchmarks of USD/m3 0.40 + USD/m3 0.40 (GWI 2004) correspond to a working ratio value of 0.5 (hence, 2 in terms of O&M cost recovery ratio);
- these benchmarks are also adopted by Banerjee and Morella (2011) for African utilities. Banerjee and Morella (2011), however, when calculating full cost recovery tariffs, sometimes adopt a hybrid solution by using the real operating cost and adding the conventional capital mark up of 0.40 USD/m3. Since O&M costs are substantially higher than 0.4 USD/m3 in Sub Saharan Africa, with an average of USD 1.2, the result for Sub Saharan Africa is that on average a working ratio of 0.75 is recommended to achieve the full cost recovery (1.33 in terms of O&M cost recovery ratio);
- another benchmark, proposed by Tyman and Kingdom (2002) is a 0.68 working ratio for developing countries utilities which corresponds to a ratio of 1.47 O&M cost recovery, even though it is not specified if it corresponds to capital cost recovery.

The present work aims at assessing whether, and under which conditions, financial results are actually associated with increasing coverage and to test if the proposed benchmarks for cost

[6] The capital premium to be added to the operational cost recovery tariff proposed by Global Water Intelligence (Global Water Intelligence 2004) is 0.40 USD/m3 and the benchmark for operation costs is the same (0.40 USD/m3), summing up to USD 0.80 for full cost recovery.

[7] There are two indicators of the operational margins which are commonly used. As one can easily notice, one of them is an exact inverse of the other one, and . They are here defined:
O&M cost recovery ratio is given by the ratio between operating revenues (Op Rev.) and operating and maintenance costs (O&M Costs) faced by the utility, so that *O&M cr=(Op Rev)/(O&M Costs)*. The value of this indicator is 1 when revenues and costs equate and exceeds 1 when the utility has positive operational margins. Working ratio is given by the ratio between operating and maintenance costs (O&M Costs) and operating revenues (Op Rev.), so that *Working Ratio=(O&M Costs)/(Op Rev)*. Again, the value of this indicator is 1 when revenues and costs equate and is below 1 when the utility has positive operational margins.

recovery are consistent with coverage goals in the African context, in order to provide some recommendations concerning the cost recovery targets that should be set for African utilities.

More specifically the hypothesis that will be tested can be reassumed as follows:

Financial performances (measured by cost recovery ratios) of the utilities do not have a positive and significant relationship with the increase of water coverage in Sub Saharan Africa. On the contrary, high levels of cost recovery are associated with decreasing coverage variation.

2.3 Description of the data set

A data set was constructed to assess the effect of cost recovery on coverage expansion while controlling for the main variables[8] which can affect changes in access, namely:

- Initial coverage: it provides a picture of the initial situation, which is faced by utilities;
- Public/ODA expenditure: it indicates the level of the investments other than the ones from financial margins of the utilities themselves;
- Non Revenue Water: it approximates the maintenance and technical efficiency of utilities;
- Urbanization: it accounts for the challenge of increasing urban population to be served.

The present section briefly introduces the content and limitations of the available databases, with particular attention to the indicators employed in this study:

- IBNET database (www.ib-net.org)
- Africa Infrastructure Knowledge Program (http://www.infrastructureafrica.org/). Within the Africa Infrastructure Country Diagnostic (AICD) there is also the so called "Fiscal database" which is taken as reference by the official studies analyzing the AICD data. This source is also quoted by Banerjee et al. (2008) and by Briceno Garmendia et al. (2008).
- United Nations, Department of Economic and Social Affairs, Population Division (2012). World Urbanization Prospects: The 2011 Revision.

The IBNET database (International Benchmarking NETwork for water and sanitation utilities) is the outcome of a global initiative of the UK Department for international development (DFID), the World Bank and the Water and Sanitation Program (WSP). It contains normalized indicators about the performances of more than 200 water and sanitation utilities from 42 countries of Sub Saharan Africa and, at the time when data were downloaded (May 2013) covers years from 1995 to 2012.

[8] Other variables were also considered but were not included for the following reasons: 1) collection efficiency (share of bills by paid divided by amount invoiced): the cost recovery indicator is already based on the actual revenues and not on the invoiced amounts; 2) continuity of supply: variables were not included about the service quality standard or the supply ladder, as I preferred to keep "access" vs "non access", as a binary option, following the as it was also the approach of the MDG monitoring (improved vs unimproved); 3) share of users served through public points: as above.

Unfortunately, for many utilities data is incomplete. Indicators reflect the main priorities of international agencies and, more particularly, their emphasis on financial performance (see Appendix A).

In the IBNET database financial results of water utilities are calculated as a ratio between revenues and operational and maintenance costs, which is also the most commonly adopted indicator of "cost recovery" adopted in the water sector[9].

Another indicator taken from the IBNET database is *Non Revenue Water* (NRW) which is the proportion of produced water that is not billed to users because it is lost due to leakages or to illegal connections. Non Revenue Water can be intended as an indicator of the maintenance status of water infrastructures (Tyman Kingdom 2002).[10] Reflecting the importance of technical water losses, NRW is a better indicator for the conditions of the pipes then for the conditions of other key assets, like treatment plants, water taps and reservoirs. Moreover, this indicator is affected by illegal connections generating losses, even in the absence of maintenance problems.

General fiscal spending is also considered, because it is here argued that public expenditure is uniquely positioned to achieve the envisaged coverage. The variable used to represent fiscal expenditure in the regression is taken from the fiscal database of the Africa Infrastructure Knowledge Program of the AfDB. In particular, the *total "on budget" public spending for water* is considered. The figures include both investment/rehabilitation and O&M expenditures, but they exclude *"off budget expenditure"*, which is more likely to include expenditure from SOEs revenues and might be correlated with financial results of the utilities.[11] The values are at country level so that the same figure was associated to many utilities in the dataset. The variable used is the ratio between total spending and the GDP of the country, which could be considered as a good indicator for the country effort. Unfortunately, the available figures can be used only as control variables, because they are collected at country level. Moreover, only one figure per country is available, calculated as an average for the period 2001-2005, with later updates in 2009. In the dataset, this

[9] It is important to notice that the analysis is restricted to the cases where the value of O&M cost recovery does not exceed 2, a threshold corresponding to revenues that double the operational costs. Since 2 is the benchmark provided by GWI (2004) and since it is the highest value available in the literature, this will allow the exclusion of cases whose values are beyond any benchmark and recommendation for cost recovery. Thus, about twenty observations of utilities with very large values of O&M cost recovery ratio are not taken into account.

[10] Tyman and Kingdom (2002) state that unaccounted for water, corresponding to NRW in the IBNET databases can be used as "a crude measure of asset maintenance" and that "this measure captures not only physical losses but also commercial losses, due to inefficient billing or illegal connections. Thus, high levels of Unaccounted For Water (UFW) indicate poor system management and poor commercial practices as well as inadequate pipeline maintenance".

[11] Since the Fiscal Database does not include a comprehensive description of the data, this information was taken from Briceno Garmendia et al. (2008, p. 9). Also the information about the period covered were taken from this source.

figure was associated to all the cases of the same time series, thereby creating a time invariant[12] variable, so that more detailed analysis cannot be based upon them.

Annual Official Development Assistance (ODA) flows to the water supply and sanitation sectors by country and year as a percentage of country GDP are taken from the same source. Additionally, the annual change of the proportion of urban population at country level from UNDESA World Urbanization Prospects 2011 is also used in the analysis. The dependent variable is the change in water coverage over the last three years measured as an absolute difference in water coverage between period *t+3* and *t (3-year difference in water coverage)*.[13] Given that in the empirical model (2.1) all the explanatory variables are taken in period t, this lagged time structure minimizes the potential endogeneity problem:

$$\Delta Y_{(t+3)-t} = \alpha + X_t\beta + \varepsilon_t \qquad (2.1)$$

All variables used in the following are summarized in

Table 2.1 below.[14] Due to data constraints, some countries are necessarily underrepresented. Thus, more than half of the utilities covered in the data set come from three countries: Nigeria, South Africa and Zambia (for more details see Table 2.4 in Appendix B). The utilities covered in the study have different dimensions in terms of population served, and no weighting is adopted.

[12] This solution can be supported by two considerations. On the one hand most of the cases are from the same years (see Table 2.2). On the other hand public expenditure has certain inertia across time.

[13] Three years were taken because of the following trade-off. On the one hand, there was the need to measure the public policy impact on a potentially larger time span (since the decisions to invest in infrastructure, based on the situation in *t* need some time to affect the utility performance and materialize in terms of actual access), but on the other hand, there was the shortcoming of reducing the data set too much by estimating those differences.

[14] Due to the heterogeneity of the data sources used, some data on the utility level had to be matched. Some matching was also necessary within the IBNET database, because the same utility has frequently been classified with different identification numbers in different years (particularly in the cases of Cameroon, Zambia, Kenya and Nigeria) and because of changes between the figures downloaded at different times (03.2011 and 05.2013). In this last case, the most recently published figure were preferred.

Table 2.1. List of variables

Indicator	Unit	Description	Source	Level	years available (with gaps)
Water Coverage	%	Population with access to water services (either with direct service connection or within reach of a public water point) as a percentage of the total population under utility's nominal responsibility	IBNET	Utility	1995-2012
Three-years difference in water coverage	%	Difference in the percentage of population having access to water services, calculated from the indicator here above	IBNET	Utility	1995-2012
O&M cost recovery	Ratio	Total annual operational revenues/Total annual operating costs	IBNET	Utility	1995-2012
Public expenditure for water	% on country GDP	Total fiscal expenditure for water including investment, rehabilitation, maintenance and operation but excluding off budget expenditures, which are more likely to include expenditure from SOEs revenues and might depend upon financial results [15]	AICD Fiscal Database 2009	Country	2001-2005 averages
Urbanization	ratio	Average Annual Rate of Change of the Urban Population	World Urbanization Prospects	Country	1950-2015 (projections) 5 years averages
Official Development Assistance (ODA) for water supply and sanitation	% on country GDP	ODA (from OECD countries) including IDA and IRDB loans and grants	AICD Fiscal Database 2009	Country	Annual values from 2002 to 2012[16]
Non-Revenue Water	%	Difference between water supplied and water sold (i.e. volume of water "lost") expressed as a percentage of net water supplied	IBNET	Utility	1995-2012

As a result, we have 25 countries (out of 49 in SSA) covered with one or more local or national utility, so that missing countries account for less than 20% of the total SSA population. In these countries 75 utilities are covered with more than 200 observations (unbalanced panel). To check whether the missing observations in the data set form any strong bias either in terms of water coverage or in terms of the O&M cost recovery ratio, the average values (for the full dataset and for the sample used for three models – namely model *b, c, d, g, h* and *i* proposed in Section 2.4) are compared with the figures on SSA region found in the literature (Table 2.2). As it can be seen, for the years 1995-2005 both cost recovery and water coverage ratios are only slightly different from those reported by other studies.

Table 2.2 Some descriptive statistics on the dataset used

	Literature on the entire SSA region		The data set of the study			
			Full Dataset		Models b,c,d,g, h, i (225 observations from 22 countries)	
Period	Water coverage (urban[17]) in %[18]	Average O&M cost recovery ratio[19]	Water coverage (reference areas of the utilities, mostly urban), in %	Average O&M cost coverage ratio	Water coverage (reference areas of the utilities, mostly urban), in %	Average O&M cost recovery ratio
1990-1995	79		-		_	-
1995-2000	68	1,00	72.13	1.26	64.64 (22 obs)	1.11
2001-2005	63		70.09	1.18	69. 9 (120 obs)	1.12
2006-2012			59.61	1.32	65.52 (83 obs)	1.07

15 As the Fiscal Database does not include a comprehensive description of data, this information was taken from Briceno Garmendia et al. (2008).

16 Annual values from 2002 to 2007 are registered, while those from 2008 to 2012 are projected.

17 Urban utilities were taken as a reference for comparison because the IBNET database utilities are mostly urban and even in the case of national utilities they are usually mandated to supply water only in some major towns.

18 Source: Banerjee et al. (2008).

19 Source: Banerjee et al. (2008).

2.4 Regression results

Below regression results obtained by testing the hypothesis stated in Section 2.2 with the data set described in Section 2.3 are provided. Since the data set is unbalanced, a regression analysis is run with pooled OLS is run, fixed and random effects. While pooled OLS is estimated as a benchmark (here no heterogeneity among utilities is modeled), fixed and random effects model this heterogeneity in two different ways: the former introduces a unit dummy variable for each utility considered and the latter models the mean and standard deviation of the distribution of those effects (for more details see Greene 2008). For both fixed and random effects estimators, cluster robust standard errors were used. This solution address the problem of errors that are not independent (autocorrelation). The use of robust standard errors does not affect the coefficient estimates, but the standard errors and the significance of coefficients.

A standard specification test for these models is the Hausman test (Hausman 1978), which however, according to recent analysis (Clark and Linzer 2015) does not always have sufficient power to reliably detect the true specification. After an extensive simulation study they find that for many units and few observations per unit (as in the case considered) random effects model may be more accurate (i.e. though potentially biased, but better constraining the variance of estimates, leading to values that are closer to the true parameters (Clark and Linzer 2012, p.7)) in cases where the test does not give a straightforward answer (e.g., significance level below 5%). Another advantage of the random effects specification is that it can be combined with time-invariant controls (such as the level of public expenditure), while fixed effects attribute the corresponding effects to the unit effects. Thus, for all models to be tested, different specifications and their differences are explored[20].

The three-year difference in water coverage was taken as a dependent variable. The water coverage in the initial period is found to be negative and strongly significant. On average, utilities with the lowest coverage in period t_0 improved their performance in terms of population coverage the most. This finding may have several explanations:

- First, those utilities that had "lowest start" could use it as an advantage and increase their coverage by reaching the most easily accessible areas first. Clearly, being closer to the full coverage requires more investments per capita as the most remote areas must be reached.

[20] Some tests were carried out on models *g* and *h*. More particularly, the residuals were compared with normal distribution and 'normality skewness and kurtosis combined test' confirmed normal distribution. A likelihood ratio test did not detected heteroskedasticity. The Wooldridge test for autocorrelation in panel data instead rejected the hypothesis of absence of first order autocorrelation, but this problem, as already explained was addressed through the use of cluster robust standard errors.

- Second, the low coverage of wide shares of the population surely generates critical public health situations and growing pressures from users. These pressures, in turn, are likely to increase the political priority among decision makers in the allocation of funds. This is quite a trivial argument but it still provides some support to the idea that, ceteris paribus, the political will matters.
- Third, it should not be forgotten that the change in water coverage is often declining in the region. This means that utilities with high initial water coverage are likely to have lost coverage as a consequence of increasing urbanization[21] and maintenance problems associated with aging infrastructures .[22]

A control for annual urbanization rate at country level was included and a proxy for poor maintenance was identified in the indicator of Non Revenue Water percentage.

Table 2.3 Presentation of the models tested

Three-year difference in water coverage	Pooled OLS				Fixed Effects	Random Effects			
	a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*
1) Initial Water Coverage	-0.38***	-0.43***	-0.44***	-0.43***	-0.86***	-0.55***	-0.58***	-0.58***	-0.58***
2) O&M cost recovery[1]	34.62***	36.04***	33.27**	30.43**	23.63**	31.47***	34.02***	28.32***	27.52***
3) Squared O&M cost recovery[1]	-14.20***	-13.58***	-12.79**	-11.91**	-10.67***	-13.81***	-14.31***	-12.32***	-12.16***
5) On budget Public Expenditure for Water[3]		9.71***	6.79*	5.74			13.32***	8.24**	7.74***
6) Non revenue water	0.03	-0.13	-0.14	-0.13	-0.21*	-0.11	-0.18**	-0.20**	-0.20**
7) Urbanization rate[2]	-1.20	-1.20	0.45	-0.26	-6.80	-2.19	-2.44	1.43	0.77
8) Oda[2]				3.61*					1.83
9) Area East Africa			6.5	5.77				9.81*	9.46*
10) Area South Africa			2.10	0.98				8.35**	7.90*
11) Area West Africa			-4.68	-5.85				-6.92	-6.00
Constant	8.03	8.66	11.15*	13.13**	62.78***	26.60***	22.32***	21.98***	22.96***
Zero slope	1.22	1.33	1.30	1.28	1.11	1.14	1.19	1.15	1.13
N obs	235	225	225	225	235	235	225	225	225
N groups					75	75	72	72	72
Goodness of fit indicators	R^2=0.25 F(5,74) = 6.88***	R^2=0.33 F(6,71) = 8.01***	R^2=0.36 F(9,71) = 8.82***	R^2=.0.36 F(10,71) = 8.09***	Within R^2=0.36 F(5,74)= 48.35 ***	Wald χ^2(5)= 82.75***	Wald χ^2 (6)= 86.85***	Wald χ^2 (9)= 108.34***	Wald χ^2 (10)= 108.01***
Hausman test					χ^2 = 20.74***				

Note: *,** and *** stand for 1, 5 and 10 % significance level, respectively. All results are provided with cluster robust standard errors.

[1] Ratios less than two in absolute value are considered.
[2] Country level.
[3] Country level and time invariant

[21] Due to the way the dependent variable is calculated (simple difference in coverage percentages over time) an increase in the denominator of the coverage variable (urbanization) affects it more for utilities starting with high initial rates.
[22] It is also probable that utilities presenting high initial coverage are also mature utilities that reached these coverage rates in many years. Thus their infrastructures might be older and in poor functioning.

The indicator for the financial result (O&M cost recovery) is associated with positive significant coefficients, but the square[23] of the same indicator, which emphasizes the effect of higher levels of cost recovery, shows a negative coefficient of comparable dimension (both are significant in most model specifications tested).[24] Adding the squared version of a continuous variable to a model, is a way to add non-linearity to the linear model. Together, 'cost recovery' and 'cost recovery squared' can describe a non monotonic relationship with one inflection point (Draper and Smith 1998).

The result obtained could mean that, at first, better financial results translate into corresponding coverage increases, but beyond certain thresholds this trend changes to the contrary one: better financial results are associated with slowness of coverage increases or even with loss of coverage. Thus, the focus on financial performances can divert efforts from ensuring universal access to water, introducing incentives and priorities which are conflicting with the MDG goal. This can also be due to the way financial results are achieved, as it will be further discussed in the conclusion.

Moreover, the results show that public expenditure is important, even if these data are at country level and they cannot be related with single utilities. Nevertheless they still express the level of public commitment. Public expenditure coefficients have always a positive and significant impact on the coverage change confirming the importance of public funding. This result might look trivial but it has some importance, since the link between public spending and improved coverage was questioned by some authors focusing on the inefficiency of public spending (van Ginneken et al. 2011, Banerjee et al. 2008). However, to give more justification in favor of benefits from public spending one would need much more detailed information (not only time variant but also indicating financial flows to single utilities).

As introduced above, Non Revenue Water is used here as an indicator of the maintenance status of water infrastructures. It was used as a control variable for its possible correlation with cost recovery, but it has also an important autonomous effect on coverage change. Reflecting the importance of technical water losses, this indicator better accounts for the conditions of the pipes than for the conditions of other key assets, like treatment plants, water taps, reservoirs. Moreover, the indicator is affected by illegal connections which can generate losses even in the absence of maintenance problems. Given these limitations, the results still show that utilities with high Non Revenue Water rates increase their users' coverage less, but the result is not always significant. This can mean that utilities with poor maintenance loose previously connected users and do not connect

[23] Controlling for O&M cost recovery raised to the third and fourth power did not yield significant results instead.
[24] Controlling for trends in cost recovery (whether the ratio was increasing or decreasing) does not show any significant impact on water coverage.

new users, since extending an infrastructure in poor conditions is generally not cost effective. This result is also consistent with the findings by Mbuvi et al. (2012) about the importance of technical inefficiency.

To check for the presence of possible spatial autocorrelation the models were repeated adding a dummy for the region of Africa (East Africa, West Africa, Central Africa and South Africa) where the utilities are located. This was done only for the methodologies that allow for time invariant variables, and the result improved the overall fitting of the model, without affecting the values of the coefficients and their significance for the main explanatory variables.[25]

Finally a control for ODA was used, whose coefficient resulted to be positive but only marginally significant. This might be due to some collinearity with other variables, namely with *On Budget Public Expenditure* (0.28) and *O&M cost recovery* (0.17). These positive correlations, could be explained by the donor favorable bias toward utilities with high cost recovery levels.

In the following, the result about the nonlinear relationship of O&M cost recovery with coverage increase will be further discussed by analyzing some features of the quadratic function identified.

The point corresponding to the maximum (*zero slope)* in the curve describing the relationship between cost recovery and change in coverage can be considered as a benchmark and compared with the recommendations available in the literature (see 2.2), about the financial results that utilities should achieve. Up to that value, the cost recovery increasingly contributes to improve the coverage, by reassuring governments and donors about the sustainability of the utility itself and by providing funds from financial margins to complement public and donors' funding. Beyond that value this is no longer observed and the coverage change gets slower or even negative.

If only the cost recovery variables are considered, the relationship takes the functional form of a quadratic function:

$$f(cr)=\alpha cr^2 + \beta cr + \varepsilon \qquad (2.2)$$

For this reason, given that α and β coefficients are estimated in the regression models in Table 2.3, the value of *cr* for zero slope can be calculated through the first derivative of the quadratic function. This value of ($\widehat{cr}$) is given by the equation

$$\widehat{cr}=-\beta/2\alpha \qquad (2.3)$$

regardless the values assumed by all the remaining variables and by the constant term, which only determine the position of the curve on the Y axis, by means of the ε coefficient.

[25] Clearly, a more detailed analysis of the geographical distribution of the utilities would be of interest, but unfortunately this information is not easily available because utilities are very heterogeneous in terms of their geographic distribution of their users basins. Some cover all the main towns of a whole country, some are at the municipal level, some cover the towns of a district or area of a country.

For the models presented above (those which account for unobserved heterogeneity with fixed or random effects), $\widehat{cr}$ is between 1.1 and 1.2. This is lower than the benchmarks provided by the literature and presented above. Figure 2.1 presents the quadratic functions corresponding to the coefficients identified in the models for O&M cost recovery and squared O&M cost recovery, with other variables assumed to be zero.

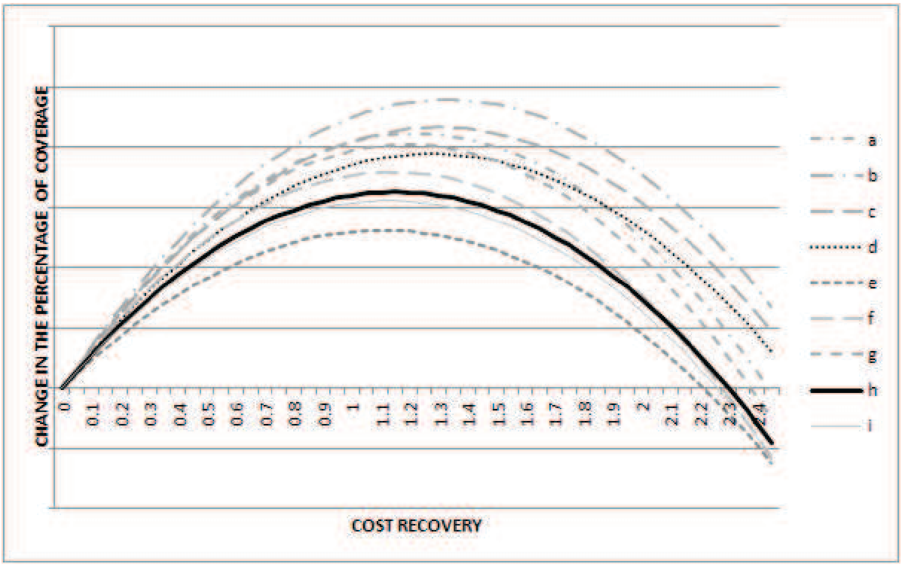

Figure 2.1 Quadratic functions for O&M cost recovery.

While the analysis above provides some insights about the values corresponding to the change of slope of the curves, it does not provide a precise idea about the dimension and sign of the coverage change. This depends upon the other variables which determine the vertical positioning of the curves. Figure 2.2 refers to the coefficients of model *h* and shows the results obtained by applying such coefficients to the mean values of the variables (initial coverage, public expenditure, NRW, urbanization, region) with the related tolerance limits covering 90% of observations with 95% probability following Howe (1969).

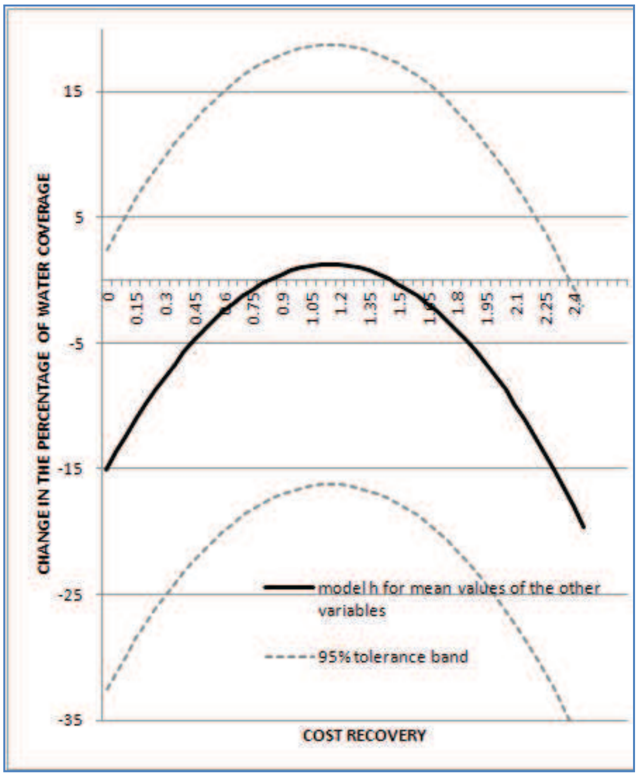

Figure 2.2 : Vertical positioning of curve for model h

It can be noticed that, for example, for mean values the level of cost recovery can make a difference between increasing and decreasing coverage, since at the level of 1.47 for the cost recovery ratio the coverage rates start decreasing in absolute terms, while already from about 1.15 the dimension of increase on water coverage declines. Similarly, the water coverage itself starts to increase only form the level of about 0.83.

2.5 Conclusion

The analysis demonstrates the importance of cost recovery, whose impact is particularly interesting. The indicator for financial result (O&M cost recovery) is associated with positive significant coefficients, but the square of the same indicator, which emphasizes the effect of higher levels of cost recovery, has a negative coefficient of comparable dimensions, that are significant in most cases. The cost recovery positively contributes to improve the coverage up to a certain value, by reassuring governments and donors about the sustainability of the utility itself and by providing funds from financial margins to complement public and donors' funding. Beyond that value this positive contribution is no longer observed and the coverage change gets lower or even negative.

The study confirmed that good financial results do not necessarily translate into corresponding increases in coverage, providing some empirical support to the warnings from descriptive studies about the fact that if utilities are urged to achieve financial results they might not be in a position to provide water services to low income customers. For example, the high tariffs and high connection charges which are made necessary by high cost recovery targets, can push low income customers toward water sources other than utility. These are often unprotected and unsafe, adversely affecting the coverage (among others Dagdeviren 2008, Bakker et al. 2008, Bayliss 2011). Similarly, overemphasizing the importance of financial results might push water operators toward big volume customers (like industrial customers) that ensure high consumption levels (sales) with small investment in distribution (few connections needed), while disregarding the low volume demand expressed by African poor households (Bayliss 2011, Bakker et al. 2008)..

Poorly designed cost control or cost reduction strategies, with maintenance interventions postponed or reduced, might also drive decreasing social returns of cost recovery, as the access rates, even in previously served areas will decrease. This is consistent with the consideration, done by van Ginneken et al. (2011), based on analysis of data from 15 SSA countries (pp. 15-16): *"low levels of non-salary recurrent expenditures severely limit public sector institutions ability to carry out their mandated roles"* and *"operation and maintenance (O&M) expenditures are too low"*.

It will be important to perform similar exercises on longer time series, once they are available.

The policy implications of the study are about the opportunity of setting high cost recovery targets for utilities by regulators or as a reference for performance contracts or in the covenants for soft loans and grants. High targets can be misleading and introduce perverse incentives for utilities managers. To provide some reference values which should not be exceeded, some computations are proposed to identify where the quadratic function changes its slope and results are compared with the recommendations from the practitioners' literature, which are generally higher: the results are between 1.1 and 1.2, while recommendations are between 1.33 and 2.

It is also possible to confirm that operational costs should possibly be recovered by utilities, with all the models associating increasing and positive changes in coverage to full O&M cost recovery (O&M cr =1).

While the study does not provide specific recommendations on the optimal mix of tariffs, taxes and transfer (TTT) to finance water supply infrastructure, it contributes to the understanding of the limitations and risks associated with overreliance on tariffs.

The study also allows the identification of some positive recommendations for utility managers seeking to increase the coverage. More particularly, recalling the results on the role played by variables in the models, it is possible to recommend that maintenance of the infrastructure should never be neglected and that a certain reliance on public and donors funding should not be blamed, given the huge task of increasing coverage in cities with a rapidly growing population.

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2.7 Appendix A: Variables in the Ib-net database

http://www.ib-net.org

Service coverage

1.1 Water Coverage (%)

1.2 Water Coverage – HH conn (%)

1.3 Water Coverage - public water points (%)

2.1 Sewerage Coverage (%)

Water consumption and production

3.1 Water Production (l/person/day)

3.2 Water Production (m3/conn/month)

4.1 Tot W Consumption (l/person/day)

4.2 Tot W Consumption (m3/conn/month)

4.3 Res. Consumption (% of tot cons)

4.4 Industrial /Commercial Consumption (% of tot cons)

4.5 Consumption by Institutes & Others (% of tot cons)

4.6 Bulk Treated Supply (% of tot cons)

4.7 Res Consumption (l/person/day)

4.8 Res Consumption conn to main supply (l/person/day)

4.9 Res Cons public W points l/person/day

Non revenue water

6.1 NRW (%)

6.2 NRW (m3/km/day)

6.3 NRW (m3/conn/day)

Metering practices

7.1 Metering Level %

8.1 % Sold

that is Metered

Pipe network performance

9.1 Pipe Breaks breaks/km/yr

10.1 Sewer Blockages (blocks/km/yr)

Costs and Staffing

11.1 Operational Cost W&WW $/m3 W sold

11.2 Operational Cost W&WW ($/m3 water produced)

11.3 Operational Cost - water only ($/m3 sold)

11.4 Operational Cost Split - % water

11.5 Operational Cost Split % WW

12.1 Staff W/1000 W conn (#/1000 W conn)

12.2 Staff W&WW/1000 W&WW conn

12.3 Staff W/1000 W pop served

12.4 Staff W&WW/1000 W&WW Pop Served

12.5 Staff WW/1000 WW conn

12.6 Staff W/1000 WW Pop Served

12.7 Staff % Water

12.8 Staff % WW

13.1 Labor costs % Operating costs

13.2 Electrical Energy Costs % Operating Costs

Quality of Service

15.1 Continuity of service (Hrs/day)

15.3 Quality of W Supplied: # tests for residual chlorine (% of required)

16.1 Complaints of W&WW services (% of W&WW conn)

17.1 WW- at least primary treatment (%)

17.2 WW- primary treatment only%

17.3 WW- secondary treatment or better (%)

Billings and collections

18.1 Average Revenue W&WW ($/m3 water sold)

18.10 WW Revenue /Pop served (US$/WW pop served)

18.2 Average Revenue W&WW ($/W conn/yr)

18.3 Average revenue - water only ($/m3 water sold)

18.4 Revenue Split - % Water (% of total for W&WW)

18.5 Revenue Split - % WW

18.6 Water Revenue - Residential (% of tot W revenue)

18.7 Water Revenue - Industrial/Commercial (% of tot W revenue)

18.8 Water Revenue - Institutions & Others (% of tot W revenue)

18.9 Water Revenue - Bulk Treated Supply (% of tot. revenue)

21.1 Ratio of Industrial to Residential Tariff

21.2 Ratio Industrial to Residential Tariff W

21.3 Ratio Industrial to Residential Tariff WW

22.1 Connection Charge water ($/conn)

22.2 Connection Charge - water (% GNI per capita)

22.3 Connection Charge sewerage $/conn

22.4 Connection Charge - sewerage (% GNI per capita)

23.1 Collection Period (Days)

23.2 Collection Ratio %

Financial Performance

24.1 Operating Cost Coverage ratio

25.1 Debt Service Ratio %

Assets

27.1 Gross Fixed Assets W&WW ($/ pop served)

27.2 Gross Fixed Assets Water ($/W pop served)

27.3 Gross Fixed Assets WW ($/WW pop served)

Affordability of services

19.1 Total Revenues/Service Pop/GNI (% GNI per capita)

19.2 Annual Bill for HH consuming 6m3 of W/Month ($/yr)

20.1 Residential Fixed Component of Tariff ($/conn/yr)

20.2 Residential Fixed Component of Tariff (% of average bill)

20.3 Residential Fixed Component of Tariff W ($/conn/yr)

20.4 Residential Fixed Component of Tariff WW ($/conn/yr)

20.5 Residential Fixed Component of Tariff W (% of average bill)

20.6 Residential Fixed Component of Tariff WW (% of average bill)

2.8 Appendix B: Descriptive statistics

Table 2.4 Descriptive statistics: mean values of the variables per area[26]

area (obs)	3 years variation of coverage	initial water coverage	non revenue water	urbanization	O&M cost recovery	Oda percentage points on GDP	public expenditure percentage points on GDP
central africa (11)	7.82	53.18	19.27	0.91	1.13	0.09	0.20
east africa (20)	10.15	61.05	37.05	1.25	1.30	0.51	0.63
south africa (117)	2.01	73.20	40.52	1.00	1.07	0.49	0.91
west africa (77)	-5.16	63.35	29.84	1.49	1.07	0.42	0.22
Total (225)	0.56	67.77	35.52	1.19	1.10	0.45	0.62
std	18.28	23.26	16.30	0.60	0.40	0.50	0.55
max	72	127	82	3.76	2	3.33	1.6
min	-81	8	1	-0.56	0.01	0	0

Table 2.5: Descriptive statistics - pairwise correlation matrix[27]

	3 years variation of coverage	initial water coverage	O&M cost recovery	squared O&M cost recovery	public expenditure	oda	non revenue water
3 years variation of coverage	1						
initial water coverage	-0.45*	1					
O&M cost recovery	0.07	0.09	1				
squared O&M cost recovery	0.03	0.04	0.96*	1			
public expenditure	0.21*	0.10	-0.09	-0.13*	1		
Oda	0.19*	-0.01	0.16*	0.12	0.28*	1	
non revenue water	0.13*	-0.18*	0.07	0.05	0.42*	0.10	1
Urbanization	-0.03	-0.03	-0.04	-0.03	-0.04	0.25*	-0.08

*significant at 95%

[26] The large volatility of the dependent variable must be acknowledged. For this reason, the same regressions was repeated excluding outliers and obtain very similar results both qualitatively and quantitatively (see Appendix C).

[27] The table refers to the sample used in models *b*, *c*, *f*, *g*. Fisher transformation allowed to identify a value of 0.13 corresponding to the absolute value that 95% of pairwise correlations would not exceed in absence of any collinearity. Out of 28 pairwise correlations computed, only 9 are above this value, so that 68%, instead of 95% are below. This small difference reflects low correlations and supports the idea that multicollinearity does not affect the dataset studied. Moreover, as argued by Spanos and McGuirk (2002), the precision of the coefficient estimators and the associated t-ratios do not necessarily decrease as the correlation among regressors increases.

2.9 Appendix C: Robustness check

Due to the fact that the main variables of interest may be subject to outliers, some additional exercises were performed in order to assess the robustness of the results presented. Analyzing data on the presence of outliers it was realized that excluding those observations from the sample which are identified as outliers by some standard techniques (e.g., based on interquartile ranges and inner and outer fences), too many observations may be lost. Thus, particularly for the dependent variable used around 20% of the sample might be deleted. To avoid such a drastic data reduction a compromise was achieved by censoring the dependent variable while deleting outliers for the independent and time variant ones.[28]

In particular, starting with the sample of 253 observations corresponding to observations available for the variables included in models *b*, *c*, *d*, *g*, *h*, *i*, without posing any restriction on the value of O&M CR rate, the dependent variable was censored adopting as censoring limits the limits identified by multiplying to the limits of first and third quartiles of the distribution by 1.5 the interquartile range (i.e. taking the so called "inner fences" or deleting "mild" outliers). Mild outliers were also deleted for all the explanatory variables with time variability, using the same methodology to calculate thresholds of acceptance (i.e. adopting inner fences for all explanatory variables used in models in Table 2.3). Tobit regression for panel data with random effects was then adopted to implement the censoring and estimate the model after deleting outliers. As a result, the sample remained of similar dimensions, 25 observations were censored and the main findings proved to be robust (neither the zero slope has considerably changed, nor any other main results discussed above), as shown in Table 2.6 below.

[28] For time invariant explanatory variables such public expenditure detection of outliers cannot be applied.

Table 2.6 Tobit regression with random effects after accounting for outliers

Three-year difference in water coverage	**Random effects**				**Limits used**	
	f1	g1	h1	i1		
					lower	upper
1) Initial Water Coverage	-0.43***	-0.45***	-0.48***	-0.46***	-2.5	137.5
2) O&M cost recovery [1]	21.64**	23.70**	17.88*	16.71*	0.5	2.37
*3) Squared O&M cost recovery**	-9.45**	-9.91**	-7.59*	-7.18*	-1.26	4.36
5) On budget Public Expenditure for Water [3]		9.22***	5.43*	5.03*		
6) Non revenue water	-0.07	-0.13*	-0.16**	-0.16**	-16	88
7) Urbanization rate [2]	-1.57	-1.72	1.38	0.93		
8) Oda [2]				1.43		
9) Area East Africa			5.90	5.49		
10) Area South Africa			7.03	6.58		
11) Area West Africa			-5.39	-5.48		
Constant	21.94***	19.38	21.07**	21.85**		
Zero slope	1.15	1.20	1.18	1.16		
N obs	234	224	224	224		
N groups	75	72	72	72		
Goodness of fit indicators	$\chi2$ (5)= 50.09***	$\chi2$ (6)= 54.64***	$\chi2$ (9)= 68.38***	$\chi2$ (10)= 69.02***		

Note: For the dependent variable the censoring was as follows: lower limit -23.5, upper limit 28.5, 17 left-censored observations, 199 uncensored observations for models g1, h1, i1 and 209 uncensored observations for model f1, 8 right-censored observations.

3 Light Private Sector Involvement initiatives in the Sub Saharan Africa water supply sector: efficiency, effectiveness and policy implications

3.1 Introduction

In the last 20 years, privatization and private sector involvement were the predominant international strategies for the reform of urban water services (World Bank 2004, Baietti et al. 2006, Prasad 2006, Hall and Lobina 2006, Goldman 2007, Castro 2008). This trend was stimulated by the Washington Consensus and by the Dublin Principles (Van Dijk 2008). In the first period private sector participation was mainly and as a first option identified with hard forms of Public Private Partnership (PPP)[29]. These forms transfer substantial risk and responsibility to the private sector for a significant period of time, like in the case of concession contracts or to a lower extent the case of lease and *affermage* contracts. In the 2000s, the World Bank (WB) and the main donors agencies however recognized that privatization policies were not going to bring in the necessary investment finance for the African water supply sector[30], as private investments were close to zero (Foster and Briceno Garmendia 2010, Table 16.6).

This was due to two main factors. Firstly, the reluctance of private investors to face investment and commercial risks in the environment of Sub Saharan Africa (SSA) countries, characterized by low profitability and high uncertainty. Secondly, public bodies and civil society have given opposition against "privatization". The dominant strategy of the new neoliberal reform model became that of corporatization and commercialization of public water services (Maghdal 2012). Corporatization and commercialization, however, do not exclude private sector involvement which continued to be a preferred option, but new solutions for private sector involvement gained momentum (Van Dijk 2008, Anderson and Janssens 2011). These solutions are here identified as light, or low risk, Private Sector Involvement (PSI) initiatives and the study aims at assessing if these PSIs achieve the expected results and at understanding the determinants of the observed performances.

[29] Following Van Dijk (2008) we only refer to Public Private Partnership when the solution involves investments by the private partner, using the wider notion of PSI for the remaining cases.
[30] According to Marin (2009) out of the more than 260 contracts awarded worldwide since 1990, 84 percent were still active at the end of 2007, and only 9 percent had been terminated early. Most cancellations were in Sub-Saharan Africa and in Latin America, among concession schemes.

With light PSIs, the main expectations from the private actors change from the provision of private finance to that of a model and guide for the public utilities to achieve efficiency gains[31]. Efficiency gains are usually seen as a condition for the improvement of the public utility management, but in some cases can be seen also as an intermediate step toward further privatization to make the financial performances of the utility more appealing for private investors.

The theoretical framework of full privatization refers to the public choice theory, stigmatizing inefficiency and captures of the public sector as opposed to private sector dynamism and efficiency. The low risk PSIs can further be associated with the conceptual framework of the New Public Management, as the private partner is expected to bring efficiency, customer and market orientation into the restructured, corporatized public utilities.

The arrangements for private sector involvement increasingly include solutions without private participation to investment and increasingly even without participation to the commercial risk. While concession contracts allocate some investment risks on the private partner and both concession and lease/*affermage* should transfer a substantial share of the commercial risk, the low risk PSIs exclude both investment and commercial risk. Management and service[32] contracts were designed to attract private partners with guarantees and devices to reduce even other types of risks. At the same time devices to anchor their payments to actual performances were usually introduced. According to Samson et al. (2003), there is a trend toward service and management contracts also to promote the participation of national contractors.

Table 3.1 summarizes the trends described, while the standard classification of the main options for private participation in the water sector can be found in 1.5.1.

[31] According to Marin (2009 p. xi) "in the challenging environment of many developing countries, the main focus of water PPP should not be about attracting direct private investment, but rather about using private operators to improve service quality and efficiency".

[32] It is important to notice that service contracts presented in the classical PSIs menu provided in 1.5.1, refer to specific tasks, resembling what we here call bare outsourcing, while the service contracts analyzed have a broader scope and involve strategic dimensions. This inconsistency is due to the fact that service contracts are sometimes forced beyond their limits.

Table 3.1: Features and evolution of PSIs in Sub Saharan Africa

Years	from 1990s	from 2000s
Type of PPP	Concession contracts Lease Affermage	Management contracts Service contracts
Objectives	Private Investments to bridge the financing gap	Efficiency gains in financial, commercial and technical efficiency (sometimes with the expectation of further privatization)
Key actors	Private partners (mostly water Multi National Corporations)	SOE state owned enterprises National (African) Private Sector Foreign Public Water Utilities
Reference Theory / Paradigm	Public choice theory	New public management
Risk allocation	Investment and commercial risk	Performance contracts
Area	Francophone Africa	Other regions of Sub Saharan Africa

Source: personal elaboration

The study reviews the performance assessments of the PSI available in literature about the African water sector and contributes to the understanding of the determinants of the observed performances. More particularly the incentive structures designed by the contracts and posed on both the private and the public partners is analyzed to explain the observed results. As most partnerships are associated with some development assistance project, the analysis also provides some insights about low risk PSI in the context of the Aid Effectiveness debate (OECD 2005 and 2012).

It is here argued that management and service contracts, while resulting from the need to promote lighter and more easily acceptable PSIs, also make the objective and expectations posed on the private partner much lighter, opening opportunities for rent seeking by operators. The cost of such initiatives, and of the various incentives considered, instead remains substantial, particularly if both the fees for the private operator and the transaction costs are considered.

The first paragraph presents the methodology and the variables selected for the analysis. The second paragraph analyzes the case studies against the selected variables. The variables are grouped into drivers of performance and determinants of the engagement in the partnership. The last paragraph draws some conclusions and provides some policy recommendations. Appendix A provides the check list used to orient the interviews about the Lilongwe Water Board (LWB) experience with PSI, as this case study included original field work.

3.2 Methodology

The chapter presents a qualitative review of case studies on PSI experiences in the water supply sector in the Sub Saharan African region. Five case studies are taken from the available literature, while the sixth includes original contributions from field work on LWB in Malawi. In November 2013, semi-structured interviews were carried out with reference persons from the parties involved in the PSI, namely the Project Manager expressed by the Operator, the Deputy General Manager of the Public Utility, and the manager of the Project Implementation Unit (PIU) in charge of supervising the implementation of projects from donors support. The checklist used to conduct the interview is provided in Appendix A. All cases refer to management and service contracts, the lightest forms in the PSI menu, as none of them involve a direct participation to commercial risk. Service contracts can be seen "*as a hybrid between a technical assistance contract and a management contract*" (Trémolet and Mansour 2014 p. i). As clarified by OECD (2009) while with management contracts, full managerial responsibility is contracted out to the external operator, a service contractor has no authority over budgeting, staffing and implementation decisions. For this reason the final responsibility for the overall performance of the utility remains with the utility management. Moreover, in the case studies presented, the scope of the partnership is broad and involves strategic dimensions.

3.2.1 Presentation of the case studies

The most significant PSIs covering management and service contracts in the water supply sector in the Sub Saharan Africa region have been selected, while contracts involving also other services such as energy and contracts below 150.000 users, like Malindi (Kenya) and Tongaat (Durban, South Africa) have been excluded.

There are two service contracts (Burkina Faso and Malawi) and four management contracts (Uganda, Johannesburg, Zambia and Ghana) in different Sub Saharan African countries.

It should be noticed that in three cases, namely Kampala, Johannesburg and Burkina Faso, the countries where the PSI was implemented is among the recognized good practices of public water supply in Africa (among others the WB publication by Baietti et al. 2006). The PSIs were later conceptualized as intermediate steps towards successful corporatization (Marin et al. 2007 and 2010), even if in some cases, at the beginning, there were expectations for further privatization. Anyway these countries, but also Zambia, Malawi and Ghana, resisted more than others against deeper forms of privatization and the studied PSI experiences did not change their orientation.

As a matter of fact, the case of Kampala covers two PSI contracts, lasting three years each: the first from 1997 and the second from 2002. The main features of the case studies are outlined in Table 3.2.

Table 3.2: Main characteristics of the case studies

	Kampala (Uganda)	Johannesburg (South Africa)	41 centres (Burkina Faso)	Copperbelt (Zambia)	Urban Areas (Ghana)	Lilongwe (Malawi)
	Management Contract	Management Contract	Service Contract	Management Contract	Management Contract	Service Contract
Years	1997-2001[33] + 2002-2004	2001-2006	2001-2005 + 2006-2007 extension	2001-2004 [34]	2006-2011	2009-2013 + 2013-2014 extension
main donors involved	GTZ (KWF German Development Bank), WB, UNDP, UNICEF, AfDB	World Bank	WB, EIB, Agence Française de Développement, KfW, African Development Bank	World Bank	World Bank	EIB EU water facility
Budget for investment associated to the PSI			Ziga dam and other investment (conditional to the PSI) 205 M$ IDA comprehensive rehabilitation/extensi on projects	Mine Township Services Project 38M$ including investment. WB loan including management fees and network rehabilitation	The contract (10.95 M€) was a components of the "Urban Water Project" (127 M$)	including Lilongwe and Blantyre the budget for investment is more than 25 M€ integration with the WB 2011-2015 2nd National Water Development Project 120M$
other PSI options considered	Divestiture	World Bank pushed for a concession		Lease	A lease launched but not finalized for internal opposition	Management Contract
Partners (public utility / Operator)	NWSC / Gauff in the 1st period and OSUL (ONDEO now SUEZ) in the 2nd period	CoJ / JOWAM (Suez + Northumbrian)	ONEA / Veolia + Mazars and Gierard	AHC-MMS / SAUR	GWCL / AVRL (Aqua Vitens + Rand LTD)	LWB / VEI
Main Sources	Jammal and Jones 2006 Ballance and Trémolet 2005 The Uganda Water & Sanitation Dialogues 2007	Marin 2009 Van Rooyen et al.2009	Ballance and Trémolet 2005 Fall et al. 2009 Marin et al. 2010	World Bank 2000 Ballance and Trémolet 2005 Cann and Jones 2006 Dagdeviren 2008 Nyambe and Feilberg 2009	Adam 2011 Dagdeviren 2013 Shang 2013 World Bank 2014	Stone and Webster 2002 Beckers and Wolters 2013 Breeveld et al. 2013 Pascual et al. 2013 Van Gilst 2013 VEI (year not available) Trémolet and Mansour 2014

Source: personal elaboration

All the PSIs are promoted by some development agencies. In four cases, Burkina, Zambia, Ghana and Malawi, there is a clear relation between the PSI and investments by the donors for the development of the water supply infrastructure. These investments are often implicitly conditional. For example in Ghana, the World Bank gave the government two options: a performance management contract which with a grant of US$130 million, or to maintain public sector

[33] Kampala Revenue Improvement Project KRIP
[34] Then taken over by Nkana, another public utility of the same area in Zambia.

management with a grant of US$30 million (Adam 2013). In the case of LWB, Van Gilst (2013 p. 9) states that *"an incentive based PS service contract was selected to address O&M (Operation and Maintenance) inefficiencies and investment needs"*. As the contractor Vitens Evides International (VEI) was not tied to any investment, the reference is clearly to the conditionality of the related investment program by European Investment Bank (EIB). This is confirmed by Trémolet and Mansour (2014) referring to service contracts as a necessary condition to access investment funds.

In all cases the duration of the contract is short, particularly because contracts are not renewed (average 4 or 5 years). The duration of the contract was not included among the variables of the analysis but, as considered by Jammal and Jones (2006) about the case study of Kampala, "*it may have minimized operator incentives to undertake long-term change"*. Also Tremolét and Mansour (2014), referring to the case of Malawi, states that "*a timeframe of 4 years was probably too ambitious"* and that a transformation like the one envisaged "*could take up to 10 years to materialize*".

As it is possible to see in the row of Table 3.2 titled "Other PSI options considered", in many cases the PSI was a second option adopted after the failure of the attempt by donors and international agencies to promote PSIs with stronger involvement of the private partner. For example in Uganda, in 1993 NWSC was among the public enterprises listed for divestiture, which was then reconsidered for civil society opposition (Water Dialogues 2007), while concessions and leases were considered in the other cases. The genesis of the LWB case is here described with some details, as its history is similar and representative of other countries as well.

In Malawi, Private Participation in the water sector was among the conditions for debt relief initiatives by International Monetary Fund (IMF) since the '90s (Pijuan and Fresnillo Sallan 2009). In 2002, PPIAF[35] consultants recommended private participation in the form of a three years management contract for the water boards of Blantyre[36] and Lilongwe, the main cities of the country, which could be progressively followed by a lease contract and a concession (Stone and Webster 2002). Contrary to privatization, from 2003 a negative response came from society, specifically from the Water Employees Trade Union of Malawi (WETUM) and the main public water companies of the country. The service contract was eventually agreed in 2007 and started in 2009 for both Blantyre and Lilongwe. As a matter of fact, the contract was the result of a long and complex mediation with the civil society and the Government, which both expressed some elements

[35] Public-Private Infrastructure Advisory Facility is a multi-donor trust fund (including the cooperation agencies of a number of OECD countries and the World Bank) that provides technical assistance to governments of developing countries to create an enabling environment conductive to private investment, including the policies, laws, regulations, institutions and governments capacity. It also supports governments to develop specific infrastructure projects with private sector participation.
[36] Blantyre is the second city of Malawi, included in the same project, but not covered by the present study.

of reluctance. According to Tremolét and Mansour (2014 p. i) "*the choice of a service contract stemmed from the reluctance of key stakeholders in the Malawian water sector and the political establishment to engage in a deeper form of PSP, as was initially proposed by the World Bank and the Ministry of Finance*" and "*Stakeholders' workshops made clear that civil society and the Water Boards were fiercely opposed to privatisation and that a "strong" form of PSP could not be imposed*."

3.2.2 Presentation of variables

All the PSIs are assessed against selected variables, most of whom are drawn from the relevant literature. Firstly, the PSIs are assessed against the nature of the expected results, usually efficiency gains expressed in terms of Key Performance Indicators (KPIs) and against their actual achievement. KPIs are the most common tool to evaluate the success of a project, and they are usually monitored by independent auditors. KPIs are identified by the PSI contracts themselves, and the analysis of the specific set of indicators adopted by each contract already provides meaningful insights on the priorities of the initiative. Moreover, based on the analysis of the final values of the KPIs, it is possible to verify the degree to which the low risk PSIs are successful.

Secondly, to get some insights on the reasons for the performances identified, the PSIs are assessed against the incentive to perform posed on the utility and on the contractor.

Thirdly, incentives to engage in the partnership are considered, to get an understanding of the effort by donor agencies and, as a consequence, by public finance to make the PSI initiative attractive for the potential contractor, acceptable in the political context and practically feasible.

Based on these elements, the effort and the actual results, some conclusions are drawn on the opportunity to actively promote low risk PSIs in the context of development cooperation and with reference to the Aid Effectiveness principles and debate. As a matter of fact, all the PSI initiatives in the region are sponsored by donors and international agencies and the promotion of PSI is a priority on the development agenda. The Paris Declaration (OECD 2005) and the Busan Principles (OECD 2012) pose increasing emphasis on the actual development results of the initiatives, focusing on the ownership of the development process by the recipient countries, and on real and fair partnerships with donors. In this framework, investments by donors in the promotion and support of low risk PSIs can thus be evaluated against their consistency with these principles.

On one hand, the incentives to perform are considered. The relevant variables are related with incentives or penalties and with the allocation of decision making power. They are the following ones.

- Responsibility and decision making power of the operator. According to Samson et al. (2003), service and management contracts tend to be less controversial than deeper forms of PSI, because they are of short duration and less authority is transferred to the private partner. However, this might also be considered a limitation encountered by private partners in their efforts to perform. The variable refers to the allocation of decision making power among personnel of the utility and personnel of the private partner. In their *Guiding Principles for the partnership of service and management contract*, Samson et al. (2003) recommend that "*contract should clearly define the role and duties of all involved. The organization system for the implementation of the contract should be specified. There should be separation of roles of client and operator*" (Samson et al. 2003 p. 32). The existence of residual rights is intrinsic to incomplete contracts, to cope with future contingencies, but it could even aim at reducing the pressure on the operator towards accountability (Dagdeviren and Robertson, 2013).
- Performance payments. Performance payments are very common tools also adopted by benchmarking regulation to introduce some competitive pressure, against set targets, in natural monopoly conditions. Benchmarking systems, providing benchmarks and target values for water utilities in different fields of their operations are increasingly available and taken as a reference for reformers, managers and practitioners (among others Tyman and Kingdom 2002). The balance between the fixed part of the contract and the one tied to some performance measure is considered to be a key element of the risk allocation in the low risk PSIs, where both investment and commercial risks are not transferred to the private partners. The theoretical reference is to the principal–agent problem which occurs when one entity (the "agent") is able to make decisions that impact, or on behalf of, another entity: the "principal". The dilemma exists because sometimes the agent is motivated to act in his own best interests rather than those of the principal (Jensen and Meckling 1976).
- Competition. The risks associated with contracting and renewal (competition for the markets) are also considered to be important elements of competitive pressure when operators are working in monopolistic settings. The presence of too few bidders can compromise the PSI gains (OECD 2008, Bayliss 2009). The expectation for a contract renewal can be an incentive for the operators to perform.

- Incentives for the staff and for the utility. Even when substantial decision making power is allocated to the private partner, the actual implementation of the measures intended to improve efficiency and to achieve the set target still depends upon the utility staff behavior. Low commitment and efficiency of public sector workers, often stigmatized by the public choice oriented literature (Niskanen 1971), should not be expected to be overcome through the introduction of a private partner as such. In management contracts, the private partner capacity to increase the efficiency of the personnel is therefore related to the possibility to provide consistent incentives and penalties. For service contracts the cooperation of the executive management of the utilities is also related with incentives and with the wider regulatory framework, if any. Resistance against privatization is also among the elements to be considered.

On the other hand the incentives to engage are considered. They mostly refer to preliminary conditions which make the PSI feasible and to the allocation of risks. According to most observers, in Public Private Partnerships the risk should lie with the party best able to manage it (for example OECD 2008, Bayliss 2009). Private operators are considered better in managing construction and operating risks, thanks to their flexibility, while the public sector can better bear risks like delays in obtaining permissions or political risks (World Bank 1997).

- Nature of the partner(ship). The nature of the partner is considered in terms of nationality and ownership. The variable considers if the foreign contractor firm is publicly or privately owned (Furlong 2010) and if it is from outside the African continent or local. A trend in the direction of public and southern contractor is identified by Bayliss (2009) *"Possibly in response to poor private sector responses, there has been an increase in South-South cooperation and in investments from state utilities rather than purely private companies"*. The cost of private finance was proposed by Balance and Trémolet (2005) as an important point to be considered when planning for a PSI, even when the PSI does not involve any investment, as a mark up on cost is necessarily charged by the private partners. Therefore the presence of a state utility in the role of the "private" partner could make some difference because it might charge lower rates of return. Another element is that the shareholders of the public firm are citizens, not investors. However, they are not the citizens served by the PSI so that they are unlikely to push the utility toward better performances, as they could do in their own country. Nonetheless public firms probably need to defend their image in the home country more than others and they are subject to higher degree of control of their performances with social and equity issues. South-South partnerships are more easily accepted, as noticed by Fall et al. (2009 p. 38): "*Successful PPPs are implemented by Local Partners (...) to dissipate the perception of foreign involvement in a socially sensitive sector and has increased the acceptability of the PPP.* Last, South-South partnership might prove to be more effective because the "private" partner already has an experience of the challenges posed by water supply in urban Africa or, more generally in the developing countries, (for example informal settlement, low income population, absolute water scarcity). The nature of the relationship between the partners is also relevant, as it can be conceptualized as commercial or not, and the partner can have aligned perceptions or not.

- Exchange and inflation risk. These risks are widely addressed in the Camdessus report (Winpenny 2003). They are more important when commercial risk is transferred to the private partner, but can also affect management and service contracts. Exchange risk can affect all contracts where foreign partners are paid in local currency, while inflation risk mostly affects the financial performances of utilities, particularly when, as it often happens, tariffs adjustments are subject to approval procedures which delay them with respect to the increase in the costs of inputs. Anyway poor financial performances, when commercial risk is not transferred to the private partner, can only affect the performance payments when financial performances and cost recovery is among the reference KPIs.

- Regulatory risk. Regulatory risk concerns the possibility that the host Government introduces changes in the law and regulation which increase the private operator's costs (for example through taxes) or reduce its revenues (through price regulation). Expropriation of the investor is also among regulatory risks. The concept of *enabling environment* for private sector involvement and subcontracting is often used to describe the absence of these obstacles and risks and refers to legislation and policies (Samson et al. 2003, World Bank 1997). The Camdessus report (Winpenny 2003) also addresses the component of regulatory risk related with the availability of finance.

- Transaction costs. A number of initiatives are necessary to facilitate and even to make possible the transaction, before and during the implementation of the contract (Coase 1937), like for example independent auditing. As noted by Ballance and Tremolét (2005) about the Africa water sector, Private Sector Participation "does generate substantial costs" even if some of them are difficult to quantify, like for example government officials time and attention. Supervising the contracts and resolving disputes can also result in substantial costs. The costs incurred by agencies like PPIAF for the promotion among policy makers, government officers and civil society, to overcome resistances and gain support for PSI initiatives should also be considered. In their *Guiding Principles for the contract preparation process of service and management contract* Samson et al. (2003) point on the importance of "*political acceptance and goodwill for the contract (…) from key stakeholders*" (Samson et al. 2003 p. 30).

3.3 Analysis and Results

3.3.1 Expected and achieved efficiency gains and their measurement

The efficiency gains pursued by the partnerships are expressed by the selected performance indicators or Key Performance Indicators (KPIs) that, as it is discussed in the next paragraph, are often used as a reference for performance payments. Table 3.3 shows the KPIs adopted by the analyzed PSIs and they are here introduced, using the same classes proposed in the table to group them. Information on the KPIs adopted and on the corresponding performance ratings are taken from literature. The results here proposed do not provide an evaluation of the single PSIs considered nor even of the low risk PSIs in general. The review here proposed instead provides some information on the expected results, on the performances, and on the measurement challenges. All of these elements, in fact, and not only the performances, are the basis of the following analysis.

Commercial and Financial Efficiency indicators are:

- Collection efficiency indicators: ratio between revenues actually collected and a target amount or, more often, the amount invoiced. In Kampala collection from public entities was treated separately, due to the common problem of insolvency by public organizations. Collection efficiency indicators are very common, found in the IBNET, in the Africa Infrastructure Country Diagnostic (AICD) database and recommended by Tyman and Kingdom (2002);
- Volume of sales: only found for the first contract in Kampala and is seldom used in the water sector, probably in consideration of water demand management priorities;
- Metering practices: Metering level is a very common indicator, expressed as percentage of connections metered, or percentage of water metered over total water produced. However less common measures were adopted by the contracts about metering. The level of 'meters reading' expressed as a percentage of meters timely read over total number of meters is not common but it can capture the effectiveness of the operations. The number of meters installed on public sector connections over the total number of public sector connections is also found and refers again to widespread problems with public sector payments.
- Operation and Maintenance (O&M) cost recovery: a ratio used to measure a company's ability to recover operating costs from annual revenues, calculated by dividing the company's annual revenues by the total annual expenses. It is found in the IBNET and AICD databases.
- Customer satisfaction is often measured by the number of complaints, usually as a percentage of the total number of connections (IBNET).

Among the KPIs adopted by the contracts there are also other indicators of commercial efficiency less documented in the literature, such as the volume of sales divided by a target value, or the level of consumption by the public sector.

Technical efficiency indicators are:

- Unaccounted for Water (UFW) or Non revenue Water (NRW): the proportion of produced water that is not billed to users because over the total water produced. This accounts for technical losses and for illegal connections (or meters tampering). They usually do not include uncollected revenues which are captured by the collection efficiency indicator. These indicators are very common and they are found in the IBNET, in the AIDC database and recommended by Tyman and Kingdom (2002).
- Water and wastewater quality: these indicators are usually calculated by the percentage of chemical tests passed (like chlorine residuals) or by the percentage volume of water treated to primary and secondary level (IBNET, AICD).
- Continuity of supply expresses the number of hours per day of water availability.

Among the KPIs adopted by the contracts there are also other, less common, indicators of technical efficiency, such as pressure in the network, Capacity Utilization, timely interventions for the maintenance, power and chemical consumption. In Uganda, and indicator of Connection Efficiency (CE) was adopted, capturing the number of active connections on total number of connections.

Access indicators are:

- Coverage: percentage of people served over the total reference population. It is a very common indicator. The number of new water kiosks is also found as a KPI in the contract considered, to reflect a coverage increase.
- Reduction of connection costs: it is not common but addresses a key problem in water access, as high connection costs prevent connection by the poor.

The main indicator for Staffing level and human resources (HR) is Labor productivity, usually measured by the number of staff per 1000 connections. It is found in the IBNET, in the AIDC database and recommended by Tyman and Kingdom (2002). In South Africa KPIs about black economic empowerment were also adopted.

Table 3.3 shows the performances of the PSIs analyzed. Underlined indicators correspond to poor achievements, while indicators in italic refer to cases where it was not possible to measure the performances, so that the KPI was not used for the purposes of performance payments. Plane text corresponds to indicators that proved to be successful according to the available sources, even if in some case specific values were not available. Figures are also provided when available for the first 5 cases, while for Lilongwe, they are provided in Table 3.4.

Table 3.3: Performances of the PSIs

	Kampala (Uganda)	Johannesburg (South Africa)	41 centres (Burkina Faso)	Copperbelt (Zambia)	Urban Areas (Ghana)	Lilongwe (Malawi)
Commercial and financial efficiency	• GAUFF collection 90% of the target • GAUFF sales 69% of target • OSUL Collection on bills (non Gov) ~100%	• bills collection and reading of meters • customer service	• bill collection from 85% to 95%	• Collection to billing +12% (< average) • O&M Cost Recovery +21% (> average)	• collection ratio decrease(from 89.1 to 89%) • *customer response* • <50% meters installed and read for public users	• O&M Cost Recovery
Technical efficiency	• OSUL: CE 80% against a target of 84% • OSUL: UFW 45% against a target of 36%.	• water and wastewater quality • timely interventions for maintenance on the network	• increased NRW	• UFW - 19%[37]	• Treated water quality and pressure • NRW increase (from 48 to 49%) • capacity utilization in treatment plants (60-75% against a target of 90%): • power consumption decreased • *chemical consumption*	• NRW
Access		• Coverage[38]	• reduction of connection costs • extension of coverage	• Coverage - 4% (in line with average)		• *continuity of supply* • n of new kiosks
HR		• human resources • black economic empowerment-	• Labor productivity			

Source: personal elaboration

All the PSIs registered some failures in some indicators and most of them registered many. The only area where most PSIs registered at least some success, is the one of commercial and financial efficiency. Johannesburg experience looks like the most successful one. However, the KPIs were not defined from the beginning by the contracting authority and were decided by the auditor during project implementation (Van Royeen 2009), while baseline values were often unavailable. It should be noticed that, following Dagdeviren (2008), the performance of the private operator in the Zambian Copperbelt were compared to the ones of other utilities in the country, not to the contract targets, and they are not worse than the average. However, one could expect that the investment in the PSI can bring in something more, particularly when its value represents such a large share of the utility turnover (see 3.3.2.2).

Some more specific comments can be derived from Table 3.3. In line with the general goals of the contracts, there is in all the case studies a main focus on improvements in financial and commercial efficiency and in technical efficiency. Access indicators are also found in some cases, but it should be noticed that in most cases they are designed to capture the degree of budget execution of complementary investment funded. As a matter of fact, investments are usually funded through donors' grants, so that their degree of execution does not measure original interventions by

[37] Improved more than average, but still 32% with a target of 30% (World Bank 2000).
[38] There was an slight increase in access, which is anyway remarkable if the 4% urbanization rate is considered.

the private operator. These indicators were classified in the access class, but they could as well be considered as efficiency indicators. The weighting system adopted to aggregate the indicators for the purpose of the performance payment would also shed some light on the priorities pursued by the PSIs, but unfortunately it was not available for enough cases.

The scope of the analyzed contracts is usually broad as reflected by the presence of indicators measuring different types of efficiency. It is also important to note that in many cases the scope of the contract is even broader than the field that the KPIs manage to capture. This leaves a part of the performance not tied to indicators. For example, in the case of the LWB contract there were a number of contractually defined tasks[39], which corresponded to deliverables, but not to indicators. This is also discussed in the session about performance payments (3.3.2.2).

In many cases the selected KPIs failed to capture the actual performances by the private partner or they prove to be weak tools. This is sometimes due to the poor definition of the target values of the indicators, to the incomplete definition of the methodology for the computation of the indicator, or to the unavailability of baseline data, or data about the progress. For example in Johannesburg, the target values of the KPIs were not defined from the beginning by the contracting authority and were decided by the auditor during project implementation (Van Royeen 2009), while baseline values were often unavailable both in Johannesburg and in Ghana (Marin et al. 2007, Dagdeviren and Robertson 2013). This makes the evaluation of effectiveness resulting from Table 3.3 even worse than apparent at first. In Lilongwe, the indicator “continuity of supply”, originally foreseen by the contract, was then removed from the KPIs. The removal was agreed by the utility and the contractor because the achievement of satisfactory values was recognized as unfeasible due to the shortage of water. The contractor proposed to develop a rationing plan but it was not further developed, so that the furthest district, mainly composed by Low Income Areas (LIAs), were simply left without water during the daily hours, when the demand is higher. Dropping the indicator indeed was the only point agreed, reflecting the failure of the partnership to address the problem. Also in the case of Ghana, the computation of the indicators values proved to be challenging. Treated water quality generally resulted to be unsatisfactory, but was not properly quantified in the terms of the KPIs and also a governmental report (Min. of Water 2010) mentioned challenges, among others in “baseline setting”. Even if the contract provided penalties against the operator for incompliance with quality standards for 2 consecutive days, failure by the operator to provide

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[39] Contractual tasks are 1) Organizational structure plan 2) Commercial Management (including integrated accounting software and customer database, tariff calculation model, metering reading and revenue collection processes) 3) Management Information System 4) Reduction of NRW (including GIS, loss reduction, leak detection and repair in distribution system, customer metering program, Illegal connections and unbilled authorized consumption 5) O&M Plans 6) Extension of water Supply services to LIA 7) Optimizing pumping regimes 8) Access to water facility 9) Public relations 10) Hiv/aids programme 11) Implementation of the Investment program (Pascual 2013 and interview with the PIU PM).

information about date and time made any sanction difficult. Similarly, data on the use of some chemicals in water treatment plants were not available. In Burkina Faso, despite the service contractors had obviously no responsibility for staffing levels, an indicator of human resources efficiency was present.

The case of LWB is discussed with more detail. Table 3.4 shows that performances during the first four years of the contract were quite poor and efficiency gains limited. Differences between the figures provided by the two sources considered might reflect changes introduced during the last year of project implementation.

Table 3.4: Targets and performances of the Service Contract for LWB

Indicator	% weight for performance payment	Baseline	target	Achieved at the end of the 4th year of the project
source	Beckers and Wolters 2013	Beckers and Wolters 2013	Trémolet and Mansour 2014	Trémolet and Mansour 2014
Non Revenue Water	50%	39%[40]	30%	37% [41]
O&M Cost Recovery	20%	1.15	1.35	2.25
N of new kiosks	15%	0	372	200
Continuity of supply	15% (then reallocated)	92%	95%	dropped

Source: personal elaboration on data coming from Beckers and Wolters 2013 and Trémolet and Mansour 2014

The performance was poor, as it is confirmed by the fact that, at the end of the 4th year of project, when targets were supposed to be fully achieved the contractor (VEI) in Lilongwe was only awarded 53% of the performance scores and of the corresponding payment.

The only achieved target was the one about cost recovery. As it is discussed in the next paragraph, however, this indicator was recognized by both the interviewed representatives of LWB and VEI to be out of VEI control, while even indirect contributions supposed to be provided by VEI, like the tariff calculation model and the customer software were not adopted. The increase was drastic, from 1.25 at the end of the 3rd year to 2.25 at the end of the 4th, but both the field work and the secondary sources failed to identify the drivers of such a drastic increase. The increase could be related to the high tariff rise accorded by the Government from August 2012, overcompensating the dramatic inflation and devaluation of the local currency[42]. Moreover, such an over-performance is not necessarily positive, as a value of 2.25 is beyond the recommended benchmarks[43] for cost recovery in developing countries and because a conflict between social and financial results is often a key trade off to be considered.

[40] The baseline was initially 31% but was reviewed upward in July 2012 (Beckers and Wolters 2013)

[41] According to Tremolét and Mansour in January 2014 the value was improved to 30%

[42] Malawi experienced a severe FOREX crisis in 2011 and 2012, also associated with shortages of fuel, which resulted in the devaluation of May 2012.

[43] For example Tyman and Kingdom (2002) propose a benchmark of 0.68 for the working ratio for developing countries utilities which corresponds to a ratio of 1.47 O&M cost recovery.

As a concluding remark it is possible to observe that the performances of the PSIs considered were below expectations or difficult to measure. In the case of service contracts it was also difficult to attribute the performances observed to the intervention of the contractor, while in the case of management contract it was easier, at least for the functions transferred to them. This is discussed in the next paragraph.

3.3.2 Incentives to perform

Sometimes it is difficult to establish a link between the performances observed and the intervention of the contractor. This takes the form of a common attribution problem with management contracts, particularly when the management of human resources is transferred and few external factors can affect the performances. In the case of service contracts instead, we can sometimes notice that the theory of change supporting the PSI project is weak itself. In these cases the link between the contractor's activity and the performance relies on strong assumptions, like the presence of a cooperative environment (addressed in the fourth part of this paragraph: 3.3.2.4). This problem is crosscutting to the first three categories of incentives analyzed, namely power, performance payments, and competition, as none of these incentives can push contractors beyond their reach.

3.3.2.1 Responsibility and decision making power for the operator

It is here argued that the lack of a clear definition and separation of the roles of the parties and little responsibility posed on the contractors can be disincentives to perform. Among the selected case studies, the most notable difference is between management and service contracts, as the latter involves a lower level of responsibility transfer and usually a less clear definition of roles. However, within the two groups and particularly within the group of management contracts, different degrees of autonomy and transfer of decision making capacity can be found. In the cases of Johannesburg, JOWAM (the consortium created by SUEZ and Northumbrian) was given a full management role, only excluding production which was traditionally unbundled in Johannesburg. Also in Kampala, the management role given both to Gauff and OSUL (first and second contract respectively) included distribution and billing, but excluded production. However the responsibility of the performance was questioned, as *"improvements would have happened even without privatization"* (Jammal and Jones 2006). In Ghana, the management role given to AVRL, included total control on revenues. However, a governmental report (Min. of Water 2010) reported the existence of challenges, among others, in the interpretation of the contract which for example foresaw that some decisions were to be taken by the operator "in consultation with" GWLC and a practical interdependence between the two in many fields, like technical and financial reporting, human resources, investment planning (Dagdeviren and Robertson 2013). In Zambia, the private operator has received the responsibility to determine daily staff assignments, jointly with the evaluation of their performance and to manage all Operation, Maintenance and Repair works of the systems, plant, equipment and other facilities. The utility AHC-MMS conversely kept some key responsibilities, through its Head Office, whose staff was not managed by the private operator and that was given the role of monitoring the performances of the PSI. Moreover they kept full control on all costs and payments (Nyambe and Feilberg 2009).

When the service contracts are considered, the role given to the contractors is basically an advisory one, with no transfer of decision making powers. In Burkina Faso "*The private partners sent two permanent staff members, initially to serve as directors of the commercial and finance departments. But the parties soon agreed that because of sensitivities, the expatriates should instead act as deputies to local managers. Many other foreign staff were sent on short-term missions as advisers. Thus the international operator had mostly an advisory role*" (Marin et al. 2010 p. 2) Even if there is a KPI about labor productivity, the operator had no responsibility on staffing levels. Some power was given to the operator by the institution of an operating investment fund (M$3) to allow him to purchase some equipment rapidly and autonomously (Marin et al. 2010).

In the case of LWB, some quotations from interviews about the role of the foreign partner are reported below. The PIU manager explained that the KPI Cost Recovery was out of VEI control, commenting that the contract was not well shaped, because the performance fee was anchored to indicators which did not reflect the operators performances. Even for the indicator about the number of water kiosks in LIA, VEI only certified the commissioning of the water posts at the end of process that was entirely managed by LWB and WaterAid[44]. According to the PIU manager, the most meaningful indicator was the one about NRW, while for the remaining the contractor should have taken the executive power. The Resident Project Manager from VEI, also recognized that VEI could not respond of the KPIs and explained that VEI recommendations were usually approved by LWB, but then they were not implemented accordingly.

The Manager of the PIU also commented that the contract was too abstract. More particularly, in many parts of the contract it is stated that *"VEI will assist LWB"* in various fields, but the meaning of "to assist" is never clarified. For these reasons the PIU manager would not recommend to use a similar contract again. According to the PIU Manager VEI should make

[44] WaterAid is a UK based international NGO (www.wateraid.org)

proposals, then LWB can agree or not, and if agreed VEI should supervises the implementation. However, the Resident Project Manager from VEI, discussing about the strengths and weaknesses of this contract design, commented that "*VEI has no control over the implementation.*" The Deputy General Manager of the LWB confirmed that, at least at the beginning, there was a problem of interpretation of the commitment by VEI "to assist" LWB, often mentioned in the contract: *"for VEI the advisory role did not imply that they had to go on the ground it should mean to work together on the ground, even in implementation and monitoring".* The lack of assistance in the implementation of the recommended procedures can related also to the comparatively low incentives for performances and to the penalties for deliverables (see 3.3.2.2) .

3.3.2.2 Performance payments

All the PSIs provided for a part of the payment to be tied to the performances, usually measured by KPIs. The scope of the contracts however can be broader.

In the second contract for Kampala (OSUL), although there were 20 quantitative performance targets, most of them were irrelevant because they were not tied to incentives or performance payments. Collection remained the most important target, and the operator's performance was appraised only against the three indicators shown in Table 3.3. Moreover, if the operator had met all targets, it could have received an additional maximum of US $250,000. This is not a strong incentive, as it only amounted to about 7% of the fixed management fee. Moreover the amount was supposed to be paid only if all the targets were fully met and there wasn't any additional bonus in case of over-performance. Jammal and Jones (2006) suggested instead that "*performance might well have been better if incentives were larger and continuous*".

In Zambia an external audit is carried out annually to determine the annual bonus of performance payment.

In the case of Ghana (Shang 2013, Dagdeviren and Robertson 2013), both performance incentives and penalties were left for the operator to determine (Dagdeviren and Robertson 2013). Penalties were excluded if failures were caused by preexisting "snag items". The operator however during contract implementation presented "everything as snag" (Dagdeviren and Robertson 2013) so that no penalties were applied. Moreover "*incentive design was more on attracting the private sector than inducing optimal performance*" (Shang 2013).

In the case of LWB, the performance based part of the payment does not foresee any penalty, while it provides for penalties to be deducted from the fixed part of the payment. According to the PIU Manager interviewed this is not recommendable. Penalties are only applied to the base fee in case of failure or delay to deliver reports and deliverables, or in case the deliverables were not approved by LWB. This, according to Trémolet and Mansour (2014), led to a great effort in report production and submission particularly in the first period of project implementation which was misleading and diverted attention from other priorities. VEI reports, timely submitted and covering all the topics included in the broad scope of the contract as presented above, were perceived by the staff of the Water Boards as “lengthy Textbook” whose implementation was not straightforward (Trémolet and Mansour 2014). Reports were probably based on internationally recognized good practices but they were not shaped to address the specific challenges faced on the ground in Lilongwe and they failed to translate them in the terms of the existing procedures and practices. The Resident Project Manager from VEI also recognized that instead of short missions[45] (he mentioned 35 weeks of experts per year covered by many different experts lasting from 1 to 3 week each), VEI would better have sent experts for longer assignments to provide not only training but also follow up on the job.

Burkina is the only case where penalties were foreseen for low performances. Physical outputs, like reports, instead were associated with a price paid to the operator for each deliverable, not with a penalty, as it was in Lilongwe. Table 3.5 provides the breakdown of the values of the contracts into fixed and performance based components, jointly with information about penalties.

Table 3.5: Composition of the payment

	Kampala[46] (Uganda)	**Johannesburg (South Africa)**	**41 centres (Burkina Faso)**	**Copperbelt (Zambia)**	**Urban Areas (Ghana)**	**Lilongwe (Malawi)**
Contract value for the whole period	M€ 4.4 ~M$5.28	~4.5 M€	M€ 3.9	M€1.5 in 2003	10.95 M€ including 5M€ for spares	M€ 2.16 Lilongwe only
Fixed payment	M€ 2.98	1.78 M€	M€ 2.6	~ 1.13 M€ in 2003	10.95 M€	1.5M €
Performance payment	7% of the fixed management fee (€ 209.000)	1.43 M€	~M€ 1.25 (max)	~ 0.45 M€ in 2003		0.66 M€
other	10% of collections above a certain target	0.18% on operational margin	a price for each specified output			No
Performance on total contract value	*32%*	*>30%*	*32%*	*≤25%*	*<15%*	*44%*
Contract value on revenues in the same period	*6%*	*<1%*	*<3% (annual revenue >M€25)*	*27%*	*4%*	*6% (revenue ~M€9* LWB report 2011-2012)
Penalties and performance bond		*€ 500,000 performance bond*	*The performance payment can also be a penalty*		*Only in case of gross negligence*	• *Penalties for deliverables[47]* • *no penalties for KPIs* • *performance security bond € 200,000*

Source: Personal elaboration

45 Almost 50% of the man-week made available by VEI Short Term Expert in the Framework of the contract were devoted to the writing phase (the first phase of the project when such reports were mainly produced) and only around 25% of this time was spent on the field (Trémolet 2014).

46 The table refers to the second phase and to the second contract (OSUL). The first contract with GAUFF only included a performance payment of 25% of revenues collected (including arrears) above a certain target and no incentives for other performances.

47 The total amount of penalties could reach 30% of the base fee. Penalties were only applied for deliverables that were under the service contractor’s full command, such as the production of reports. There was also the possibility to terminate the contract by LWB if the weighted average achievement of all targets was less than 50%. However, in practice it was possible only if the Auditor agreed that the shortfall was the service contractor sole responsibility, which is technically impossible under a service contract.

Some general comments can be derived from Table 3.5:

- The performance payment usually represents an important share of the overall contract value. Ghana is an exception and its performances were particularly poor.
- Performance payment should be linked to variables which depend upon the effort and the capacity of the private partner, otherwise even high percentage of the payment tied to performance can be ineffective (like in Burkina and in Lilongwe).
- The value of the contract on revenues does not usually exceed the 6% of the revenues for the reference period. Zambia seems to be an important exception. Also the 6% of LWB seem to be high if one considers that the management role is not covered and management fees are excluded (in Burkina, where the other service contract considered was implemented, the percentage is below 3%).
- Penalties seem to be unevenly used.

3.3.2.3 Competition

During the time period covered by the contracts there was an improvement in the selection procedures, with increasing transparency and competition. The numbers of bidders also increased.

In Uganda, the first PSI, with Gauff, was contracted through sole-sourcing, while OSUL, the second contractor, was selected through competitive bidding. In Burkina Faso there were 3 bidders only.

In Johannesburg a two steps procedure was adopted with seven pre-qualifying bidders from around the world: Acea SpA (Italy), Thames Water (UK), Azurix Services (USA), Vivendi (France), Suez & Northumbrian Water Group (France/UK), Severn Trent (UK), and later Corporation of Western Australia. Five of them submitted final proposals and Suez & Northumbrian won, registering as JOWAM (Marin et al. 2007).

In Lilongwe a two steps procedure was launched and two bidders were shortlisted out of six who submitted a proposal in the first round (VEI and VEOLIA). According to the PIU, VEI won because VEOLIA submitted a higher financial proposal and left some activities *"back to the client"* (PIU). Activities “back to the client” might mean that, after the experience in Burkina, Veolia tried to avoid the replication of an unclear allocation of responsibilities, which often characterizes service contracts and which later proved to be challenging also for by VEI (see 3.3.2.1).

In the case of Ghana, there were few bids and AVRL’s proposal probably was better and lower, in terms of financial offer, than the other (Shang 2014). No information was retrieved from the literature about the selection procedure for the contractor of Zambia.

The trend towards increasing competition for the market and more transparent procedures is a positive one, but it should also be noticed that it was associated with the development and adoption of devices designed to mitigate the risk posed on the private partner in the bidding phase. In the case of Malawi, 50,000 € were refunded to the failing bidder participating in the second step of the selection procedure, which lasted 3 months for detailed proposals (Trémolet and Mansour 2014).

The expectation of a renewal can be an incentive to perform. Renewal never occurred in the cases considered and only in the case of Johannesburg and Kampala, the initial expectations for renewal lasted long enough be an incentive. In Ghana, despite a lease was envisaged for the period following the contract (Dagdeviren and Robertson 2013), the management reverted to the public sector and also the company created at the end of the contract in 2011 was closed, rejoining the asset holding company. In July 2013, *"two years after this move and seven years following the experimentation with private sector participation, Government of Ghana has finally decided to give GWCL workers one more chance to operate water supply systems in the country"* (GWCL 2013) with a backward move toward integrated public service.

In Kampala, for example, the original contract provided for a one-year negotiated extension. Performance targets were agreed, but negotiations broke down on the issue of the management fees, and in February 2004, were halted. Also for Johannesburg, which was probably the most successful contract among the case studies considered, there were expectations of renewal.

In the two cases of service contracts (Burkina and LWB), the contracts were actually extended. Yet this should not be considered a success because the extension aimed at giving more time to the private operator to reach the performance targets that remained unmet, without allocating extra budget. In the case of Lilongwe, the total cost of the one year extension of the contract was € 1,290,000, and around 25% was funded by VEI from bonus payments already received and the rest came from the budget for the un-awarded performance bonus (see 3.3.1).

The analysis of the case studies makes it possible to conclude that renewal seldom occurs and that the lack of expectations of a renewal, therefore, is a disincentive to perform in this kind of contracts.

3.3.2.4 Incentives for the staff and for the utility

None of the analyzed PSI experiences included explicit incentives for the utility to cooperate with the contractor to jointly achieve the project goals and to follow its recommendations. This is due to the fact that the willingness to cooperate by the utility was taken as an assumption, despite the presence of resistances among executives and staff was known in advance by all the parties, being among the key reasons for the selection of light form of PSI.

The type of the incentives to be considered differs according to the category of contract: incentives to the workers are relevant in the case of management contract, while incentives to the utility as an institution have to be considered in the case of service contracts, as the executive management remains under the public utility.

When management contracts are considered, poor cooperation by the utility workers was registered in the case of Ghana. Referring to this case study, Shang (2013) explains that the negative, not cooperative, attitude of the staff of GWLC was due to the fact that "*the PPP was based on the assumption that they were incompetent"*.

This disempowerment feeling was likely to be absent or at least less strong in the case of Zambia and in Johannesburg, because the utilities were newly established. In the case of Johannesburg, JW (the utility then managed by JOWAM) was a newly created one resulting from the integration of six different operational units of the municipality, City of Johannesburg (CoJ), incorporated in 2000. This happened within a major restructuring and corporatization initiative undertaken by CoJ in many sectors following its own strategy and priorities, which is likely to improve the perception of ownership about the PSI. In the case of Zambia, when the mines of the Copperbelt area were privatized, the new owner did not want to manage water supply and other municipal services. AHC-MMS, the local utility, was incorporated as a company in 1999, only two year before the beginning of the PSI contract. About the first PSI in Kampala, Samson et al. (2003) poses a question mark on the issue whether the processes were properly managed to get the support of the senior management of the public utility and of key stakeholders, to avoid sabotage and foster team working. About disempowerment the same author states that most middle managers felt discriminated and they "*have resorted to sitting and earning salary for nothing*" (Vol 2 p. 122) while also the lower level staff reported about poor relationship with the expatriate staff.

Another relevant dimension is the degree of control by the contractor over the utility staff and particularly the possibility to award benefits and salary incentives. In Johannesburg salary incentives and benefits were largely used by the private contractor: the average salary increases by 23% and 693 promotions have been made. In other two cases of management contracts (Zambia and Ghana), the contractor has only been transferred the operational management of staff but not the human resources management. Particularly, in Zambia the private operator was supposed to manage the staff from an operational perspective only, without the possibility of providing incentives. In Ghana (Shang 2013) although 3000 members of staff were seconded to AVRL, AVRL did not have the power to fire or to promote people, nor even to increase salaries. According to the representative of the contractor this *"means you have very small power to influence the operations of the company"*.

As concerns the service contracts, expatriates from the service contractors had obviously no responsibility for staffing levels, even if in Burkina Faso an indicator of human resources efficiency was present. In Burkina Faso the expatriate staff simply hold the positions of deputy managers of the commercial and financial departments, coaching local management without hierarchical responsibilities over the staff of the local utility, ONEA, with important limitations to their capacity to guide the staff toward the objectives. In Lilongwe their role was the one of advisors and scarce cooperation was registered. The Deputy General Manager reported that "*there was resistance by the LWB staff toward VEI and VEI was frustrated".* To address this lack of incentives, VEI proposed an arrangement to share the performance payments with the Water Boards, but this solution was not implemented (Trémolet and Mansour 2014). The caretaker model with caretakers and NRW teams at zone level[48] included an idea of competition among zones which could also provide incentive to the middle and base level staff, but it was at a low level and probably it came too late.

As a concluding remark, it is possible to state that the cooperation is critical to the success of light PSI and it often fails to be achieved.

3.3.3 Incentives to engage

3.3.3.1 Nature of the partner(ship)

Among the contractors of the six case studies there are multinational corporations (MNCs) operating in the water sector, consulting firms and foreign public utilities, both from the European and the African continent. As a matter of fact, the oldest case studies include MNCs of the water sector and, in the most recent cases, public utilities from abroad. Only in one case there is a public utility from another African county. It is here shown that the advantages of the public nature of the partners fail to compensate the top-down genesis of the partnership, while it might explain some risk adverse attitude..

The first contract in Kampala was awarded to a German consulting firm. The second contract in Kampala and the contract in Zambia were with French MNCs. Jowam, the contractor of the PSI in Johannesburg, was also owned 66% by a French MNC, while in Burkina another French MNC was awarded the contract, jointly with an international auditing firm.

[48] The caretaker model is about technical losses and about the management of minor maintenance interventions on the distribution network. The caretaker approach is in line with the District Metered Area (DMA) approach that fragments the supply areas in smaller areas for more effective control of the network. Caretakers have vehicles and leakages detectors and each knows well his reference area from the social and the technical point of view. VEI has set up NRW task forces, trasversal to the operational units of LWB and including members of the customer services, the accounting and the distribution units (Trémolet and Mansour 2014).

These four cases indeed, are dominated by traditional actors of the sector, while the remaining two cases witness the new trends described in the methodological part of the chapter (3.2.2).

In Ghana, AVRL is a consortium by Aqua Vitens and Rand LTD. Vitens is one of the two big Dutch public water utilities, owned by provinces and municipalities. Rand Water is the largest bulk water utility in Africa, providing bulk potable water to more than 11 million people in South Africa and it is also public. VEI (Vitens Evides International)[49], the entity awarded the service contract in Malawi, for both Blantyre and Lilongwe, was created by Vitens, the company awarded the contract in Ghana, and by its homologue Evides, the other main public water company in the Netherlands, for the specific purpose of assisting developing countries utilities, on a non-profit basis.

If the experience of the partners is considered, in the first contract of Kampala, GAUFF, being a consulting firm, had no previous experience in operating water systems. The lack of experience of Gauff according to Jammal and Jones (2006) helped explain the subsequent poor performance. Ghana was the first international experience of VEI (Trémolet and Mansour 2014), done through Aqua Vitens and senior management positions were filled by personnel lacking adequate experience (Dagdeviren and Robertson 2013). As a consequence Malawi was the second international experience of VEI. This means that new, less experienced actors can be attracted by these low risk PSIs. In Lilongwe, as VEI had no experience about LIA supply issues, WaterAid participation in the project was probably intended to fill this gap, with a focus on Water Users Associations for the management of public taps.

The implications of public ownership can better be understood by exploring the cases of Ghana and Malawi. In the case of Ghana, a governmental report (Min. Of Water 2010) assessed the Status of the Management Contract mentions challenges including the relations between the partners, among others. This contradicts the expectation of peaceful cooperation among public partners.

In Malawi, the partner VEI should be classified as public foreign firm. The article by Pascual et al. (2013) conceptualizes the partnership as a Water Operators’ Partnership (WOP). WOPs are peer-support arrangements between two or more water or sanitation operators, carried

[49] Vitens Evides International is the result of a venture of the two largest public water utilities in the Netherlands: Vitens and Evides. The venture was born in 2005 as a response to public interest and political request for supporting international water projects. VEI is a small group, with 20 staff currently in total, but relies on the expertise of Vitens’ and Evides’ staff.

out on a not-for-profit basis with the objective of strengthening their capacity[50]. The not-for-profit basis of WOPs is technically consistent with the status of VEI, which is a non profit entity, but it does not fit well with a performance based service contract. The non-profit nature of VEI was probably among the success factors for the contract award, due to the lower financial proposal submitted, but the perceptions of the nature of the partnership were not aligned. LWB representatives and the PIU pointed out the commercial nature of the partnership, while VEI defined it as a WOP, motivating the definition with the consideration that both partners are public and that VEI only recovers the costs faced for the project. Moreover, the representative of VEI declared the intention to give back the performance payment to the board and, in case the full payment was not awarded, to provide the difference from their own pocket." The inconsistency in the perception of the two parties and the top-down genesis of the partnership itself make the peer cooperation implicit in the WOPs approach hardly applicable.

About responsiveness to performance incentives, Trémolet and Mansour (2014) underlines that VEI bid for a fixed fee to recover its costs and that, regardless the final design of the contract, it remained focused on the fixed fee. This resulted in the adoption of a risk adverse attitude, aiming at avoiding penalties (see 3.3.2.2) by timely fulfilling the reporting requirements instead of addressing the KPIs challenges, reflecting the priorities of VEI public shareholders from the Netherlands (Trémolet and Mansour 2014). A perfunctory attitude can also explain why VEI did not pre-finance items on water boards budget (like maps and bulk meters) nor even on its own budget (like additional human resources in the initial phase), even if they were critical to the success of the project (Trémolet and Mansour 2014).

3.3.3.2 Exchange rate and inflation risk

Exchange and inflation risks posed on the private partners by management and service contracts are generally low. In the cases where they materialized, however, the risk allocation was claimed to be unfair by the private partners and in most cases things were accommodated in their favor. The following information and considerations are retrieved from some of the case studies, while for the remaining case studies no relevant information was found.

In Kampala, during the first year of the second contract, the contractor OSUL asked for a renegotiation of the contract, with a 20% increase in the management fee to compensate the higher-than-anticipated costs of operations, foreign staff expenses, and deterioration of the Euro/Dollar

[50] WOPs are being promoted by GWOPA, the Global Water Operators' Partnerships Alliance , a network of partners promoted by UN Habitat and committed to improve their collective capacity to provide access to water and sanitation services for all. www.gwopa.org

exchange rate. An international accounting firm was engaged to investigate these claims. Though the claims were held to be legally invalid, a small increase in the management fee was granted.

When Burkina Faso is considered the foreign exchange risk is limited, because the country belongs to the CFA Franc zone. The exchange rate of the CFAF to the Euro is fixed, in fact, and the private partner is from France. In Ghana Payments were in dollar currency (Shang 2013).

In Malawi the contract was in Euro. The only currency risk was related to the cost recovery KPI. During contract implementation in fact, there was an increase of the costs of imported inputs, due to a 40% devaluation of Malawian currency in May 2012. However, this did not affect Cost Recovery, thanks to the prompt adjustment of the tariff (+26%) in August 2012 and in 2013.

Among the main reasons for the poor and delayed performances on the NRW KPI there is the delay in the procurement of bulk meters. This is explained by the difficulties in securing foreign exchange from the Government. Trémolet and Mansour (2014) argues that foreign exchange was supposed to be available for the project, as it was financed in Euro currency, but money were temporarily diverted for other priorities, due to a major foreign exchange crisis at country level[51]. This consideration, in the analysis of Trémolet and Mansour (2014), calls for an additional reduction of the risk posed on the contractor, which should be not given for granted. If contractors work in unrealistic settings, simulated by donors through the local governments, this might enable them to perform better than other actors do, but risk reduction has a cost and the performances do not account for the real world challenges that the other actors face.

3.3.3.3 Regulatory risk

The absence of investment commitments in the low risk PSI makes the risk of expropriation not relevant, while the absence of commercial risk in both service and management contracts also protects the private partner from the risk arising from price regulation. Donors backing and promotion of the partnership is also an important element which reduced the regulatory risk for these contracts.

In the case of Ghana the contract made explicit provisions about the responsibility of the grantor (the local partner) to facilitate relationship with State Agencies, including for tax exemptions. Even the new government policy of settling its debts in Kampala, indicated by Jammal and Jones (2006) as a reason for the success in bills' collection by Gauff, can be seen as a removal of regulatory risk.

Conversely in Lilongwe, the contractor faced some regulatory risk, even if only indirectly. As a matter of fact, the success of the cost recovery KPI depended upon revenues and on the

[51] Malawi experienced a severe FOREX crisis in 2011 and 2012, also associated with shortages of fuel, which resulted in the devaluation of May 2012.

procedure to approve tariff adjustment. Both the annual budget and any tariff adjustment need the approval of the Department of Statutory Corporations and of the Ministry of Water. However, as it was seen above, tariff adjustments were approved during the period and the level of Cost Recovery was above any expectation. Moreover, the representative from VEI reported about the problems with custom procedures and the long time to achieve tax free entry from the revenue authority. These were among the reasons for delayed procurement and, consequently, for poor KPIs value for NRW. In this case some regulatory risk was left to the operator, who in turn perceived this allocation of risk as unfair.

3.3.3.4 Transaction costs

Some figures about the dimension of the transaction costs in the selected case studies are available. Transaction costs prove to be very huge, particularly if compared with the relatively small dimensions of the contracts themselves. A PSI relationship can be conceptualized in terms of the agency theory, with the contracting authority in charge of supervising the work of the agent (the private partner) based on the information available (Shang 2014). The contracting authority can be the utility itself, represented by the head office or by the executives, or the line ministry. Agency costs related to formal monitoring, auditing and control can be quantified. Moreover one should consider the costs related associated to the effort to share information, orientations and decisions among the personnel expressed by the private operator and by the utility respectively. These are likely to be proportional to the importance of the role left to the utility executives. This means that it will be maximum in service contracts and will be lower in management contracts where the private operator also manages human resources. The transaction costs here considered also include costs related with the preliminary activity to improve political acceptance.

In Kampala the costs of the transaction advisor and of the technical and financial audit was 435,000 € (Ballance and Trémolet 2005). In Johannesburg, around € 200,000 were spent for the independent auditor (Marin 2009), while, preliminary to the contract, Halcrow Management Sciences was appointed as Transaction Advisor and funded by World Bank Technical Assistance. In Burkina Faso the difference between cost of the project value and the cost of management services was 1.3M€, which probably include, jointly with the performance monitoring by independent technical auditors, other transaction costs. In Zambia, there was a 2.4 M€ WB of pre-project funding (Ballance and Trémolet 2005) and in Ghana various initiatives were financed by PPIAF to promote private sector involvement.

As concerns LWB, it is possible to see that there are both costs related with the implementation phase and costs related with the preliminary activities that were necessary to make the PSI accepted. The Audit of the project cost was of € 100,000 (€ 65,000 for the auditor Mott

MacDonald Ltd and € 35,000 for the partner). A "Private Sector Transaction Advisor" was also appointed to design and supervise the bidding and contracting phases, but it was not possible to retrieve the costs of this service. Trémolet and Mansour (2014) suggest that some shortcomings could have been avoided by a "marriage counselor" to clarify the mutual expectations of partners. This did not happen but could mean that additional, even higher, transaction costs should be covered to improve the PSIs performances.

Costs related to the political acceptance are also substantial. In 2005 the World Bank (IDA 2005) p. 2-3, commenting the delay in the privatization process in water and other utilities states that: "*Over time, the levels of resistance to the program increased as people took the view that there was no consultation taking place between the Privatization Commission*[52] *and its stakeholders*" but that there is "*high level political support*". A public awareness campaign was thus launched by funding media (television, radio and press) programs targeted at specific stakeholder groups such as members of Parliament, trade unions, employees and state owned enterprises and civil society. Similarly PPIAF faced transaction costs related with the promotion of the idea of private involvement (PPIAF 2012) for a value of more than 1M$ between 2000 and 2007[53].

3.4 Conclusions and policy implications

Low risk PSIs resulted from a compromise between the resistances of utilities, civil society and governments against the private sector and the reluctance of the private sector to take on risks. Also the expectations posed on private sector were reduced. The low risk PSIs proved to be acceptable for both the public and the private actors involved. Nonetheless they were then characterized by important shortcomings and high costs. The balance between risk reduction and performance incentives proved to be delicate. In fact, the reduction of some risks causes a reduction of the incentives to perform. At the same time, the conditions to make the partnerships feasible proved to be costly. In the end, the PSIs succeeded to engage the actors from both parts, but they failed to make them perform.

The review of the case studies shows that low risk PSIs are characterized by a standard neoliberal definition of efficiency focused on commercial improvements and, in most cases, by poor performances. High shares of the contract value are usually tied to performance, but contracts are incomplete and computation of the KPIs is often questionable, while performances are sometimes out of the control of the operator itself. A narrow decision making space for the contractors was also

[52] Privatization Commission: a Privatization Commission (PC) was created in 1994 within the Government of Malawi and supported by the World Bank.

[53] 2000 Increasing Private Sector Participation in the Provision of Water Supply Services, $ 194,350; 2001 Harmonization of the Institutional and Regulatory Framework, $ 200,000; 2005 PPP Legal and Regulatory Framework, $ 269,000; 2006 Developing a Public Communication Strategy for Urban Water Sector Reform, $ 149,500; 2007 PPP Implementation—Development of Regulations and Procedures, $ 251,500.

found to be a common challenge, but at the same time the restriction of the role of the contractor is intrinsic to light PSIs and it was necessary to overcome political resistances. Payments tied to deliverables and fixed payments can result in a perfunctory attitude by the operator. In the bidding phase, competition for the market was low, with few bidders, particularly for the earlier case studies, while, later, compensation for the bidding effort was recognized. There are virtually no realistic expectations that contracts' renewal will take place, so that there are no incentive to perform for contractors. Utilities have no incentives to cooperate with the contractors and the resistance against the private partnerships was a common feature. Lighter PSIs failed to make the private sector more acceptable for utilities, but in turn, by reducing its autonomy, they made the cooperation of public utilities critical to the success of the PSIs. Trémolet and Mansour (2014) advocate a stronger alignment of formal incentives for the contractor and for the utility. This, however, would further increase the complexity of the contracts design and the transaction costs, if incentives for the utilities are not part of a wider regulatory framework. In turn, a well functioning regulatory framework should be considered a priority as such, and not only a precondition for PSIs, as the success of formal incentive systems in Uganda, Burkina and Zambia in the context of public water services confirms. The analysis of the partners' nature revealed that publicly owned contractors did not enjoy a more cooperative environment, while some findings indicate that they could be less sensitive to performance incentives than private contractors. The low risk PSIs are characterized by devices to reduce or remove exchange, inflation and regulatory risks borne by contractor and more devices are invocated by observers when any element of the local institutional and market context challenges the smooth implementation of projects. Such devices, however, are costly and pose the operator in unrealistic settings, so that it is impossible to know if efficiency gains will be sustainable in real world settings. Moreover, the introduction of devices for risk reduction is not consistent with the general recommendations published by the WB itself. Banerjee and Morella (2011), for example, proposes a 'State Owned Enterprises Governance Index' with positive factors contributing to this index including: 'no exemption from taxation', 'access to debt compared with private sector' and 'no state guarantees'. Lastly, the contracts considered have disproportionally high transaction costs, particularly if the limited expectations from these PSIs, are recognized.

While low risk PSIs tend to deliver limited efficiency gains, if any, to the utility and that their costs are disproportionally high. Moreover, even looking beyond immediate results, the capacity building that could be expected from a peaceful cooperation between the utility staff and international experts (Pascual et al. 2013) is often jeopardized by widespread resistances.

By jointly considering the poor performances, the uncertain role of contractors to achieve them and the facilitating devices, the accountability for the results of light PSIs seems questionable. As accountability for results is among the principles of Paris and Busan (OECD 2005 and 2012), this challenges the Aid Effectiveness of low risk PSIs.

Based on the study, light, low risk PSIs, cannot be recommended, but this does not mean that higher risk PSIs should be rehabilitated. If PSIs could be seen as a last attempt to realize Private Sector Involvement, the failure of the last attempt, should virtually imply the recognition of a wider failure of any form of PSI. However, all forms of PSIs are still promoted, as the trend toward low risk PSIs is not linear and a number of other parallel evolutions and further attempts can be tracked in the SSA water sector.

Light PSIs are virtually positioned somewhere in the continuum between bare outsourcing and higher risk PSI, with the dimension and importance of functions transferred to the private increasing moving from the first towards the latter. On both ends of the continuum simpler devices are found and the roles are more clearly defined, even if only full integration (which means full privatization or no PSI at all) excludes problems of residual rights (Dagdeviren and Robertson 2013). In both cases the performances of the private operator have a higher degree of independence from the utility and, so that at least the private contractor is more accountable and rent seeking less likely.

Outsourcing seems now a preferred business model for MNCs in the sector. Suez and Veolia launched 'new service businesses, which are essentially monocline offerings, such as smart metering, non revenue water management, energy recovery' GWI (2012), so that potential markets for private water services can include 'countries without privatization minded governments.'

On the opposite side of the continuum, hence in the direction of increasing the risk and commitment by the private actor, there are higher risk PSIs which might experience a revival if the recent shift from affermage to concession is Senegal in considered.

In SSA, there is also a revival of technical assistance contracts, more close to low risk light PSI, as shown for example by the technical assistance contracts in Zambia and Ghana, both with VEI.

PSIs are thus evolving in many directions, but the study can provide a conclusion which is valid for any form of PSI. The analysis underlines the perverse and contradictory effects of 'rushing and pushing' (Dagdeviren and Robertson 2013) private sector involvement when none of the actors is willing to engage in these experiences. This paradox was particularly apparent for light PSIs, due to the low expectations and low results and to the high transaction costs, but this can be the case for any form of PSI. Forcing PSIs is not in line with the principle of ownership of the Paris declaration:

‘partner countries exercise effective leadership over their development policies, and strategies and co-ordinate development actions’ (OECD 2005 pp.3).

PSIs should be implemented only when they are perceived as a need by the beneficiary utility, the local institutions and civil society, and they should not be related to any implicit or explicit conditionality. This would make the complex architectures to reduce risk and to attract the private sector useless. PSI is costly and diverts attention from key priorities of the SSA water sector, like the need for increasing coverage and alternative strategies to make financing available. In conclusion, PSI should not be considered a priority as such if the Aid Effectiveness in the water sector, in line with the objectives of the international community, has to be increased.

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3.6 Appendix A: Checklist used for semi-structured interviews

1. *Which are the main differences between a "services contract" and a "management contract"?*
2. *Are there similarities with the "monoline service model" proposed by GWI ? Is the conceptualization of the contract in the terms of a WOP (Water Operators Partnerships), proposed by Pascual et al. (2013), more suitable?*
3. *The performance payment is associated to efficiency gains: how are these efficiency gains exactly defined?*
4. *Which are the final target and results for the Key Performance Indicators (KPIs)?*
5. *Are there contractual KPIs other than the ones in the charts in annex?*
6. *Do these KPIs well reflect the challenges and priorities that the Water Board had to address in 2009? Are there other priorities which were not addressed by the contract?*
7. *How could VEI respond of the efficiency gains in the absence of a management role by the private partner? Is there any contractually defined space/scope where VEI has an executive role? And in the informal daily practice? Is there any example of solutions/initiatives promoted by VEI to address the problems of efficiency and then adopted/refused by the Board?*
8. *Did the expertise of private sector actor VEI prove to be suitable to bring in the expected efficiency gains?*
9. *Referring to the contractual tasks listed in Annex 3 which are most important similarities and differences between the professional and organizational skills which make VITENS and EVIDES successful in the Netherlands and the ones which are necessary in the Lilongwe context?*
10. *Which were the main criteria which lead to the selection of VEI in the competitive procedure to select the service provider?*
11. *The improvement in utilities efficiency pursued by new generation PPPs and more generally by the reform agenda for public utilities are sometimes seen as paving the way for further privatization, making utilities more appealing for private investors. The Malawi Water Sector Investment Plan issued in 2012 considers a number of options for future PSP (annex 4). Which of the PSP Hypothesis you consider the most feasible, positive and why, if any? Which are the most risky for universal access to water supply?*

4 Priorities and tools for Water Demand Management in urban Africa: a focus on household level water metering

4.1 Introduction

Increasing the level of water metering is a key point of all the initiatives for the operational restructuring of African water utilities promoted by donors and development agencies from the '90s. Water metering penetration is among the most common benchmarking indicators[54] which are adopted to measure the performances of water utilities throughout the world[55]. Household level water metering is usually considered a good practice and recommended. Under an economic perspective, it involves transmitting price signals to water users to ensure efficiency in the allocation of the water resource, which cannot be transmitted by a fixed fee. For this reason metering is a main tool for Water Demand Management (WDM) (Arlosoroff 1998, Macy 1999, Gumbo and Van der Zaag 2002, Mulwafu et al. 2003), which aims at keeping the demand for water reasonably low, in consideration of environmental scarcity. The idea is that consumption can only go down if people are confronted with their actual consumption and they pay accordingly. Under a more technical perspective, metering is also considered a main solution to reduce Non Revenue Water (NRW) and Unaccounted for Water (UFW)[56] caused by leakages and illegal connections, as it allows technicians to locate the area where leakages occur and to detect and repair them. Metering is thus supported by a water conservation argument and by a social equity argument (Staddon 2010). The social equity argument basically relies on the idea that, through metering, everyone is charged what she actually consumes. This reflects a liberal view of equity, while the actual social equity outcomes of a metered system largely depend on the tariff system which is used.

While other benchmarks and targets set for the African water sector remain largely unmet, water metering at household and water point level, was widely adopted. *"In Africa, water metering is surprisingly widespread, with many utilities reporting 100% metering in their service areas. (...) the average metering ratio is 75 %."* (Banerjee 2010 p. 6). The idea that metering level should approximate universal coverage is widely accepted and recommended for developing countries (World Bank 2008, Kingdom et al. 2006).

The study discusses the arguments behind the widespread acceptance of the target of 100% metering, focusing on the suitability of household level metering for low income settlements of

[54] See for example the AICD and IBNET database introduced in section 2.3.
[55] Two indicators are mainly utilized, these are: proportion of metered connection over the total number of connections and proportion of metered water over the total volume of sold water.
[56] Sometimes the same indicator is also called Unaccounted For Water (UFW).

urban Africa. Universal metering is opposed to selective metering, which can be based on the selection, by the utility of the customers to be metered, or can be based on their voluntary enrolment in a metering program. Voluntary enrolment is prone to a bias, as only the customers whose consumption is low are likely to save money by measuring the actual volumes, while customers with high consumption will probably prefer the flat rate. This is the situation described by Lago and Möller-Gulland (2012) and it could be described as adverse selection[57]. However, selective metering can also be based on the strategy of the utility to discriminate among customer categories so that the problem of adverse selection is no longer relevant. This opens some opportunity for poor, informal neighbourhoods of African cities.

To better understand the approach of the study it could be useful to point at the governance and policy determinants of technological change. Metering, in this view, can be considered part of the *piped water paradigm* as defined by Lobina (2012), jointly with other technologies incorporated in urban water supply systems. This paradigm was transferred from the global North[58] to the global South in the 20th century in the context of colonial and economic hegemony (Braadbaart 2009, Lobina and Hall 2010).

A similar perspective does not imply any judgment about the suitability of the technologies associated to this paradigm to answer the needs of southern urban dwellers, but it should allow an open minded relativistic perspective. There is a technological path dependency associated with the option for household level water metering, but path breaking innovation might bring in new opportunities to address specific needs which were not present in the context where the technology was first selected (Mokyr 1992).

In the first part of the chapter, the solution of household level metering is discussed based on the available evidence from literature review and secondary data analysis, both referred to the African context. Firstly, household level water metering is considered in its consistency with the specific features of the context of African low income settlements and of African utilities operations. This also includes a regression model to assess the impact of metering on average domestic consumption versus non domestic consumption, based on IBNET data. Secondly, household level water metering, considered a good practice itself, is analyzed to assess its consistency with other trends and good practices promoted and recognized in the wider water sector for African urban areas and for the developing world.

[57] Adverse selection is related to information asymmetries and it occurs when a product or service is selected by only a certain group of people who offer the worst return for the company and, in this case, also for the society which fails to achieve the water conservation outcomes envisaged.

[58] Metering is part of the municipal hydraulic paradigm but some exceptions do exist even in Western Europe. As a matter of fact, there are some countries whose water supply strategy does not include household level metering, like Ireland, Norway and, until recently, the U.K.

In the second part of the chapter, the case of Lilongwe Water Board is discussed on the basis of key informants interviews, available literature and internal reports. The aim is to understand how metering contributed or failed to contribute to the extension of household level water supply in low income areas and to the development and implementation of efficient and effective billing and collection practices. The contribution of household level metering to WDM is also discussed and alternative WDM strategies are considered.

The third part of the chapter, based on both the literature analysis and the case study, draws some conclusions. Appendix A provides the checklists used for semi-structured interviews carried out in Lilongwe, while Appendix B provides an attempt to describe the consumption decisions of water users in terms of the game theory, drawing possible developments for further research.

The hypothesis is that the quest for universal household level metering can prevent SSA water utilities from connecting poor households in Low Income Areas. It is argued that universal metering should not be intended as the metering of each household, but should more loosely be referred to the correspondence between meters and billings. 100% household level metering should not be considered a target for all the SSA water utilities in all the low income contexts and informal settlements. Alternative solutions, also consistent with wider orientations of the African water supply sector, should be considered, explored and piloted, when relevant.

4.2 Findings from the literature and from secondary data analysis

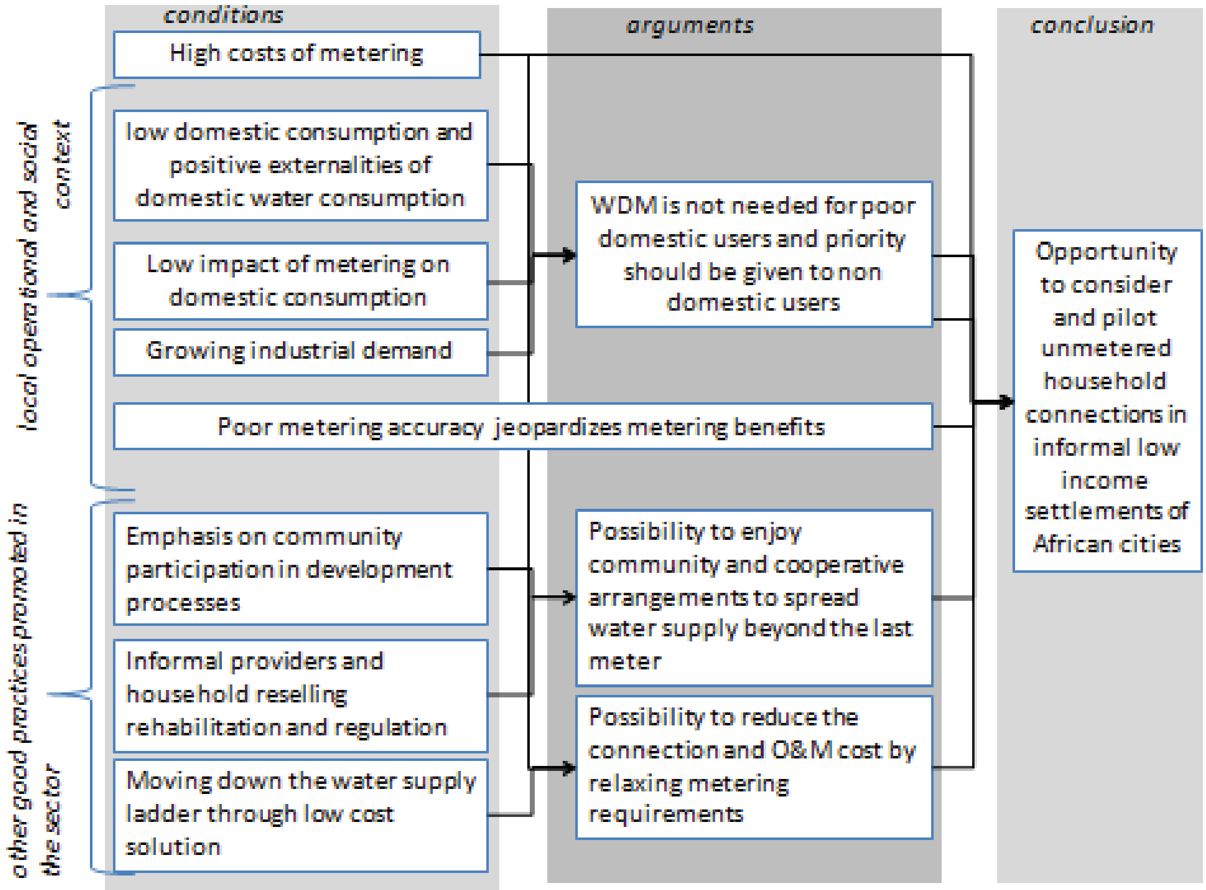
Universal water metering has seldom been criticized by practitioners and scholars and the few critical contributions available refer only to developed countries and to the recent initiative of introducing metering in the UK (Jenkis 2006, NCC 2002, Staddon 2010, Zetland 2013). The main arguments against universal metering from this literature are the inability of metering to achieve the expected reduction in domestic consumption and the high costs of metering (Jenkis 2006).

Referring to the first argument, the inability of metering to achieve the expected reduction in domestic consumption, it is due, among others, to low price elasticity, inaccessibility of meters by consumers and failure of water bills to communicate volumetric information in an accessible way (Staddon 2010). As regards the second argument, the high costs of metering and their disproportionate impact on low income groups was discussed by Jenkins (2006).

The first part of the present paragraph translates these two arguments in the context of urban Africa. Moreover other conditions and characteristics, which are specific to the context of urban African utilities, are presented: the low level of domestic consumption and the positive externalities of domestic water consumption; the poor accuracy of metering; the growth of industrial demand. They are based on water sector literature which does not directly refer to metering issues, but nonetheless has relevant implications on them.

The second part of the paragraph introduces some good practices that are promoted in the water sector in the developing world. They are community participation, informal providers' regulation and low cost solutions. These good practices do not address metering issues straight but they have implications on recommendable metering practices. These implications will be discussed to assess if 100% household level metering is consistent with the trends observed in the wider sector. The chart below (Figure 4.1) summarizes how these arguments are linked together and jointly support the opportunity of considering alternative solutions for household level water supply in Low Income Areas of urban Sub Saharan Africa.

Figure 4.1: Arguments to challenge the household level metering dogma



Source: personal elaboration

4.2.1 High costs of metering

The share of metering costs over operating and maintenance costs can be substantial and should be carefully considered, jointly with the opportunity cost of investing in meters. Jenkins (2006, p. 8) suggests that "*policy makers should reflect carefully on the use of metering, particularly when financial resources are subject to competing demands in relation to the need to improve the quality, access, and availability of water resources within society*."

The cost of metering devices is estimated to account for 1/10 of connection costs by the Africa Infrastructure Country Diagnostic (AICD) studies (Africon 2008) but the total cost is much higher if operation and maintenance cost of meters is considered. The estimation of the costs associated to metering, including purchase, maintenance, reading and volumetric billing is not straightforward and few data are available. Ofwat in 2000-2001 (OFWAT 2003) estimated this cost to be around £ 17.5 (around € 24.5 at 2003 rates) per meter per year, which was about 6% of an average bill. Assuming, however, that the proportions between metering costs and other costs are similar, it is likely to impact much more in a low consumption environment, like the one of African cities, than in the UK. Other authors estimate this value to be much higher, like £ 47 (UREGNI 2007) and £ 80 (Staddon 2010 p. 5). The considerations above show that potential savings from metering could contribute to downscaling the costs without affecting service quality (see paragraph 4.2.3.3).

Also the most recent developments of the metering technology, like prepaid meters and SMART metering, implicitly point at the high costs and labor intensity of traditional metering. Prepaid metering programs are sometimes justified as a means to reduce the high costs and the complexity associated with reading and billing of traditional meters (Peters 2011). Smart metering, which is based on ICT for the automatic transmission of data[59], is appreciated, particularly in developed countries, for its potential in the reduction of the labor needed by traditional metering.

However, while prepaid meters are seen as a morally inacceptable solution by many observers (among others McDonald and Ruiters 2012), wider critical analysis about water meters in the context of low income areas of African cities are still missing and the present work aims at contributing to fill this gap.

4.2.2 Is household level metering consistent with the context?

4.2.2.1 Low consumption and positive externalities.

It is recognized that in the context of Sub Saharan Africa consumption levels are still within, or even below, the minimum amounts that are necessary for a decent life. For example, Banerjee and Morella (2011, p. 135) recognize that there is no strong evidence of wasteful use of water in Africa, and that *"the relatively modest levels of consumption would not be further reduced by a more aggressive use of demand management tools*". Overconsumption is also technically limited by the widespread absence of drainage networks. The absence of overconsumption problems holds for domestic consumption, unless the domestic supply is diverted for productive purposes, as it

[59] Smart metering technology is designed to be remotely read and to be linked to variable tariffs, be easily read locally, and therefore meaningful to consumers, be linked to internet databases rather like bank accounts.

sometimes happens, for example, for agricultural production. This is however a deliberate violation of the rules which define the scope of domestic connections and it poses problems of the regulation which go beyond metering.

The existence of positive externalities makes appropriate to compare the costs of water supply to the total benefits resulting from it, which should include both the public and the private ones. Public benefits of water (and sanitation) systems are related with the provision of public protection from communicable diseases (Budds and McGranahan 2003). Water provision clearly provides private benefits to the receiving household. However, if people are unwilling or unable to purchase enough water of good quality to protect their own health, and they contract diseases as a result, then the health of others is also put at risk. For this reason the benefits of having an additional user include both the user's private benefits and the related external (collective) benefits.

These considerations show that investing in WDM tools is not a priority when domestic consumption of African urban poor is considered.

4.2.2.2 Low impact of metering on domestic consumption

The ability of metering to reduce domestic consumption was assessed and compared with the ability of metering to reduce the average consumption, including all the categories of users. Some regressions on panel data, with 158 annual observations from 56 utilities from 20 SSA countries between 1997 and 2009 from the IBNET database are here presented. Fixed and random effects were tested, after detecting and eliminating hard outliers[60]. Two dependent variables were used with the same regressors, in order to capture the specific features of domestic water demand against the metering level. These variables are:

- average per capita daily consumption (litres per capita per day - lpcpd), including domestic, industrial, commercial and institutional consumption;
- average per capita daily domestic consumption (lpcpd). Domestic water consumption includes both domestic connections and public points and is to be intended as opposed to institutional and commercial/industrial consumption.

It is important to notice that both these figures are only estimates and that they have important limitations in their accuracy when trying to capture the real per capita consumption levels. A main challenge to the reliability of these estimations is related to the fact that in the countries considered several households use the same tap. The percentage of users served through public water points was taken as control variable because, for obvious logistic reasons, their consumption is usually lower than the one of users enjoying household connections. The per capita

[60] Hard outliers are defined as the ones located outside the so called "outer fences" of the distribution, identified by multiplying the limits of first and third quartiles of the distribution by 3 times the value of the interquartile range.

GDP expressed in Purchasing Power Parity of the country was taken as control variable because higher living standards are likely to increase water consumption, *ceteris paribus*. The average revenue to the water utility per cubic meter sold was used to approximate the price of water, even if complete tariff structures would be necessary to identify the specific rates charged to different users categories and to domestic users at different levels of consumption (in the common case of Increasing Block Tariffs), in consideration of different price elasticity. For each dependent variable two time frames were tested: in the first frame, all the variables are taken in the same year; in the second frame, in order to exclude potential endogeneity risks and to account for the inertia of behavioural adaptation to change, the variable about the level of metering and the one approximating water price are taken with a lag of one year. This lag structure unfortunately reduces the number of available cases so that it can be only considered as robustness check. The results are shown in Table 4.1.

Table 4.1 Effects of metering on consumption: regressions results

	Dependent variable: average per capita daily consumption, including domestic, industrial, commercial and institutional				Dependent variable: average per capita daily domestic consumption			
	Without time lag		With time lag		Without time lag		With time lag	
	Random effects	Fixed Effects	Random effects	Fixed Effects	Random effects	Fixed Effects	Random effects	Fixed Effects
Metering level (% water metered on total water sold)	-0.70***	-0.69**	-0.73***	-.0.77*	-0.39*	-0.38	-0.68**	-1.12
% of users served through public water points on the total number of users	-24.05*	-20.77	-17.45	0.07	-11.17	-3.95	-13.96	-0.13
Per capita GDP of the country in PPP	0.01***	0.01*	0.01***	0.01	0.01***	0.00	0.01***	-0.01
Average revenue per m3 (tariff)	-8.05	-4.28	3.98	11.37**	-2.79	5.19	1.59	10.73***
Constant	126.07***	128.14***	126.40***	128.87***	77.30***	84.18***	106.00***	155.31**
N obs	158	158	109	109	158	158	109	109
N groups	56	56	34	34	56	56	34	34
Goodness of fit indicators	Wald $\chi^2(4)$= 55.54***	Within R^2 =0.21 F(4,55)= 3.07**	Wald$\chi^2(4)$= 34.64***	Within R^2=0.11 F(4,33)= 3.76**	Wald $\chi^2(4)$=29. 55***	Within R^2=0.05 F(4,55)= 0.71	Wald $\chi^2(4)$=13.89** *	Within R^2=0.16 F(4,33)= 11.06***

The results show that metering has a significant negative impact on the average level of total consumption per capita, while its impact is lower and less significant, or not significant at all when only domestic consumption is considered. Coefficients of domestic consumption are almost always less significant and usually lower than the ones of overall consumption[61]. These results are also robust to the lagged time frame.

The other variables have the expected sign but they are not significant in all cases. The variable approximating water price unexpectedly shows some significant positive coefficients in the

[61] However it is also important to notice that these same findings refer to average consumption and don't exclude that, among very poor households, metering can prevent the access to water, particularly if associated to regressive tariff structures or to prepayment solutions, with the related public health problems.

lagged models[62]. The lack of significance (or lower significance) of the impact of metering level on the average level of per capita domestic consumption is not an argument against metering as such, but it at least provides some orientation for priorities when allocating scarce resources to costly metering programs. At the same time the results confirm the importance and the potential of metering for non-domestic water demand management.

4.2.2.3 Growing industrial demand

Domestic water demand elasticity to price is very low at the levels of consumption of African poor dwellers, since it is impossible for people to reduce consumption below the threshold of the basic need. On the contrary, price elasticity of the industrial and productive demand of water is much higher, since new processes and equipment can be designed to reduce the amount of water used.

While increasing water scarcity is getting of major concern and domestic demand is increasingly controlled, water intensive businesses are spreading in Africa. This issue is extensively documented by the studies based on the approach of the water footprint[63] and virtual water which quantify the amount of water necessary for different productions and consider the impact of international trade on the water balance of countries (among other Ercin and Hoekstra 2014).

Countries and individual cities in the developing world are competing among them to attract foreign investments in fields related with the exploitation of natural resources and also in water intensive sectors. While in the developed world business increasingly moved toward self-reliance in the access to water when drinking water standards are not necessary, supply of manufactures by water utilities is still widely practiced in Africa and the volumes in absolute terms are increasing, as a consequence of economic growth and industrialization.

The patterns of industrial water consumption and the corresponding charges by utilities are particularly important because of the rates of growth of SSA economies: 5.5% in 2010 according the Africa Economic Outlook 2012 (African Development Bank 2012) and because of the fact that industrial commercial tariffs are often below the thresholds conventionally adopted for full cost recovery levels (Banerjee et al. 2010) for both O&M and capital costs. The effort toward cost recovery tariffs for domestic consumption, as a matter of fact, did not yield proportional outcomes when commercial and industrial tariffs are considered[64]. In fact some utilities have industrial tariff

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[62] A similar finding was justified by Banerjee (2008) as follows: "the tariff rates are near cost-recovery levels at high levels of consumption. Particularly for high-volume nonresidential consumers, utility clients pay a substantially higher price per unit of consumption". The lagged structure of the models however should in principle reduce this effect.

[63] See for example the material available at www.waterfootprint.org

[64] Underpricing can be due to investment promotion priorities transferred to utilities to compete with other countries and cities and attract investments. Utilities can also be driven by microeconomic principles of price discrimination so that a

lower than the domestic ones and their average ratio was below 3, still in 2007 (source personal elaboration on IBNET data). This considerations point at the possibility to improve the management of commercial and industrial water demands.

4.2.2.4 Poor metering practices

Metering is considered a main tool to measure and address Non Revenue Water (NRW) problems. Water balances are made possible by the comparison of water flows at production, at bulk meters and at users meters, but also minimum night flows allows the estimation of NRW (Morrison 2004). Moreover, meters accuracy is itself a cause of apparent water losses, which are differences between the volumes metered at production and the ones metered at consumption which are not due to actual water loss, but to measurement errors. In fact metering errors, for new and properly installed meters, are estimated to be around 5% and to increase with the age of the meter and with low pressure (Mutikanga 2012). Mutikanga also finds that actual errors in Kampala were higher than 20% in 2007-2009 and also registered a rate of failure of 6.6% per year (number of failed meters over total number of meters installed). Moreover, it should be considered that the practice of estimating the consumption of metered connections in the absence of records from timely readings for billing purposes is widespread in Africa (Chikasema 2009). This practice also jeopardizes the effectiveness of metering and the transmission of price signals. Low pressure is a driver of under registration, while rationing practices and failures to provide 24 hours water services can cause the presence of air in the pipes and result in over registration. Poor maintenance and testing of meters are also among the main drivers of poor metering performances. The poor metering accuracy which characterizes most African utilities is very relevant when considering the costs and benefits of metering. This was properly expressed by Mutikanga (2012, p. 103), as follows: *"when metering is inefficient, all benefits associated with metering are lost"*.

4.2.3 Is household level metering consistent with water sector good practices?

4.2.3.1 Community participation

Community participation has a long history (Kwo 1984 and 1986): self-help was the main British strategy for implementation of the new welfare orientated colonial development policy from the '50s (Page 2003). Community participation gained momentum after the structural adjustment in the '80s and '90s to fill the gap between the pressing needs of vulnerable strata of African societies

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higher price is charged to the low elasticity segment, and a lower price is charged to the high elasticity segment. Lastly, there could be a capture of regulators and utilities managers by business groups.

and the minimum state, providing minimum service, if any. As properly described by Page (2003), community participation "*has now become the development orthodoxy"*.

Community participation in the management of water supply in Africa was first adopted in rural areas but increasingly adopted also in urban low income areas, where private participation was first considered as a preferred option to fill the financial gaps left by the public service. It entails involving users in the construction and operation of water supply systems. Communities can provide funds before construction, voluntary or paid workers during construction and operate and maintain the system. Community bodies can also be the owner of the infrastructure. As part of the operation of any community run system managers are also expected to organise the collection of fees from users (Yacoob 1990, Yacoob and Walker 1991).

Central to the organisation of such systems is some variant of a ''community water committee'', a representative body, often resulting from some kind of election, in charge of managing water supply in a particular community (Page 2003). Water Users Associations or water users entities are also a common device for both water supply and water resources management in Africa. While elite capture is often observed and the inclusiveness and representativeness of these institutions are sometimes questionable (Kemerink et al.[65] 2013), they are usually recognized as legitimate counterparts by donors and formal institutions, including urban water utilities[66]. Participatory approaches are sometimes biased toward market based solutions and the appeal of business opportunities can be among the reasons for frequent elite capture of grassroots institutions. However, there might be a potential still to be sized to involve urban communities in different organizational arrangements which do not involve reselling beyond the last meter. Community based management, as a matter of fact, should not imply the adoption by community entities of market instruments for the allocation of the resources managed and a wide range of cooperative solutions can be adopted (Ostrom 1990).

For example, Mara and Alabaster (2006) propose three solutions for group connections, namely standpipes cooperatives, yard tap cooperatives and in house multiple taps cooperatives. When metering is considered, Mara and Alabaster are quite radical and only provide for in house multiple taps cooperatives to be metered at a collective level, while the remaining two should not be metered at all. As specified by the authors, cooperatives are to be intended here with the meaning of consumers' cooperatives or bulk purchasers and not with the meaning of service providers, which is closer to the Wold Bank concept (Ruiz-Mier and Van Ginneken 2006) and to the case of regulated alternative providers addressed in the next paragraph.

[65] The work by Kemerink et al. referred to WUAs operating at the water basin level in the management of the water resources, but similar considerations could be extended to water supply management experiences.
[66] This is a kind of paradox of Top-down legitimatiion of bottom up institutions.

4.2.3.2 Informal providers regulation

Water reselling regulation, and more generally the regulation of small scale informal providers, are receiving increasing attention both by practitioners and scholars (Gerlach and Franceys 2009 and 2010). The debate focuses on how to enjoy their potential to expand water access, while mitigating the risks related to their informal status (unreliable water quality, uncontrolled prices). Unregulated reselling of utility water can only be tolerated in a fully metered environment. Otherwise the few connected users could resell any volume of water while paying a flat monthly fee. Tolerance without regulation and without purposely designed devices and tariffs does not yield optimal outcomes. As noticed by Boland and Whittington (1998), in fact, the widespread adoption of increasing block tariffs (IBT) in metered environments can have adverse effects on unconnected users. As a matter of fact, the connected users who resell water to unconnected ones tend to charge at least the high rates corresponding to high consumption levels.

A partially metered environment instead forces utilities to introduce convenient regulatory solutions for reselling by household and small scale providers. In fact only purposely authorized, metered customers should be allowed to resell and the tariff applied to them and the final price should be controlled Delegated management is among the solutions available to move upstream the boundaries of direct management of the last water meter by the utility (WSP 2009). It is built around a contractual relationship between water utilities and small-scale private operators who have the financial incentives to increase access and improve services (WSP 2009). Better regulation of reselling could therefore allow utility to relax the metering dogma.

4.2.3.3 Low cost water supply solutions

The consideration of the high costs associated to universal metering at household level, is particularly important and relevant if we consider the recent orientation of the World Bank and donors agencies towards the downscale of the water supply standards (ladders), also advocated by Banerjee and Morella (2011, p. 247): *"the availability of lower-cost technologies has the potential to reduce the funding gap"*. After recognizing that the water MDG was off-track in Sub Saharan Africa, the solution proposed focuses on efficiency savings and try to downscale the standards for water supply and sanitation. This basically means to focus on water provision through public water points instead of private household level connections. This solution was seen as a limitation to the right to water access by Water Justice[67] exponents (personal notes from Marseille World Water Forum 2012) and actually makes a difference in terms of health and hygiene standards that it can

[67] www.waterjustice.org

ensure, as it is confirmed by the WHO classification in Table 4.2. Dagdeviren and Robertson (2008, p. 4) share the view that low cost solutions are not optimal: "*Low-cost and quick-fix solutions may be important in mitigating the adverse effects of lack of access to water in the slums."* because *"a decent solution that is sustainable over the long term is beyond the commercialised world of WSS systems"*. If water supply costs have to be reduced, relaxing metering standards offers an opportunity for saving without affecting the service standards.

Table 4.2: Water supply ladder

Service level	Access measure	Needs met	Level of health concern
No access (quantity collected often below 5 l/c/d)	More than 1000m or 30 minutes total collection time	Consumption – cannot be assured Hygiene – not possible (unless practised at source)	Very high
Basic access (average quantity unlikely to exceed 20 l/c/d)	Between 100 and 1000m or 5 to 30 minutes total collection time	Consumption – should be assured Hygiene – handwashing and basic food hygiene possible laundry/bathing difficult to assure unless carried out at source	High
Intermediate access (average quantity about 50 l/c/d)	Water delivered through one tap on-plot (or within 100m or 5 minutes total collection time)	Consumption – assured Hygiene – all basic personal and food hygiene assured; laundry and bathing should also be assured	Low
Optimal access (average quantity 100 l/c/d and above)	Water supplied through multiple taps continuously	Consumption – all needs met Hygiene – all needs should be met	Very low

Source: Howard and Bartram 2003

4.3 A case study: water supply in Low Income Areas by Lilongwe Water Board

The paragraph describes the successes and challenges recently encountered by Lilongwe Water Board (LWB), the public utility for Lilongwe city, in the effort to provide water to Low Income Areas (LIA), which are informal settlements and traditional housing areas. The analysis is based on the review of secondary sources, like reports, published studies and on semi-structured interviews carried out in November 2013 with the staff of LWB: the Project Implementation Unit, the Deputy General Manager, and some staff from Zone Offices - and with other relevant organizations – WaterAid[68], the Malawian Chamber of Commerce and the Malawian Revenue Authority. The checklist used to conduct the interview is provided in Appendix A.

Lilongwe is the largest city in Malawi and its administrative capital since 1975. Lilongwe has witnessed a high urbanization rate ever since, accelerated by the relocation of all government head offices from Blantyre to Lilongwe from 2005. The population of Lilongwe in 2008 was 669,021 and it is expected to reach 1,000,000 in 2015. About 76% of this population was living in the informal settlements, where water is supplied mainly through public kiosks. The water coverage

[68] WaterAid is a UK based international NGO (www.wateraid.org)

was 55% in 2012 (VEI 2013). The sewerage system in Lilongwe covers only 9% of the city and Lilongwe City Council is currently managing wastewater in the city, but LWB is supposed to take over this responsibility of wastewater and sanitation. The majority of Lilongwe's residents, especially in the informal settlements, relies on pit latrines for human waste disposal.

Lilongwe is divided into 59 administrative areas, identified by a progressive number. There is not a strict correspondence between the boundaries of the low income areas (LIAs) and the ones of the administrative areas. However it is possible to state that at least 16 administrative areas include LIAs. The metering level has been 100%, among the connected households, at least since the beginning of the 21th century, as household level metering was the dominant strategy.

In 2009, the European Investment Bank (EIB) and the ACP-EU Water Facility (WF) financed Blantyre and Lilongwe Water Board to achieve by 2013, among other goals, an extension of drinking water services to 723,000 additional persons in low income areas in both cities.

The case study is relevant to the present analysis because, even if funding was available for household connection in LIA, LWB gave up implementing the corresponding program also due to the complexity, the high cost and the frequent failures associated with the management of such connections in informal areas. It will be argued that demanding metering standards were among the elements determining such complexity, high costs and failures.

Moreover, also in Lilongwe, there is a tendency to mix participatory and market devices, with the result that community based entities operate as businesses. Lastly, also in Lilongwe, the opportunity to address non domestic water demand management was not fully sized yet. The present part of the chapter will cover the same topics addressed in the previous one, with reference to the specific case study.

4.3.1 High costs of metering in Lilongwe

According to LWB annual report 2011-2012 (LWB 2013), meters are the 4th asset of LWB in terms of value (notes to the financial statements p. 42) but their estimated useful life is 5 years only (p. 35), while for other assets the depreciation time horizon is much longer. The results obtained by Mutikanga for Uganda range from 3 to 13 years for the optimal replacement time (Mutikanga 2012).

505 MKW, corresponding to around 1 €, is the monthly rent of a meter charged to users and it is also the cost of the first 5 cubic meters (6 cm is usually considered the basic household consumption), so meter rents accounts for half the average bill for low income households.

Table 4.3 indicates the costs of purchasing households and commercial meters of different diameters for the Board, with a minimum cost of € 34 for small household meters.

Table 4.3 Price of meters

Diameter (mm)	€	Typical of
15	34	Households
20	35	
25	59	
40	101	Commercial

Source: PIU office

4.3.2 Low domestic consumption and the supply ladder in LWB

Average consumption per residential connection is lower in areas with LIAs than in other areas. In the analysed period (2007-2013), average monthly consumption per domestic connection was 16 cubic meters in administrative areas with LIA, against 41cm in areas which do not include LIAs, as shown in the Figure 4.2.

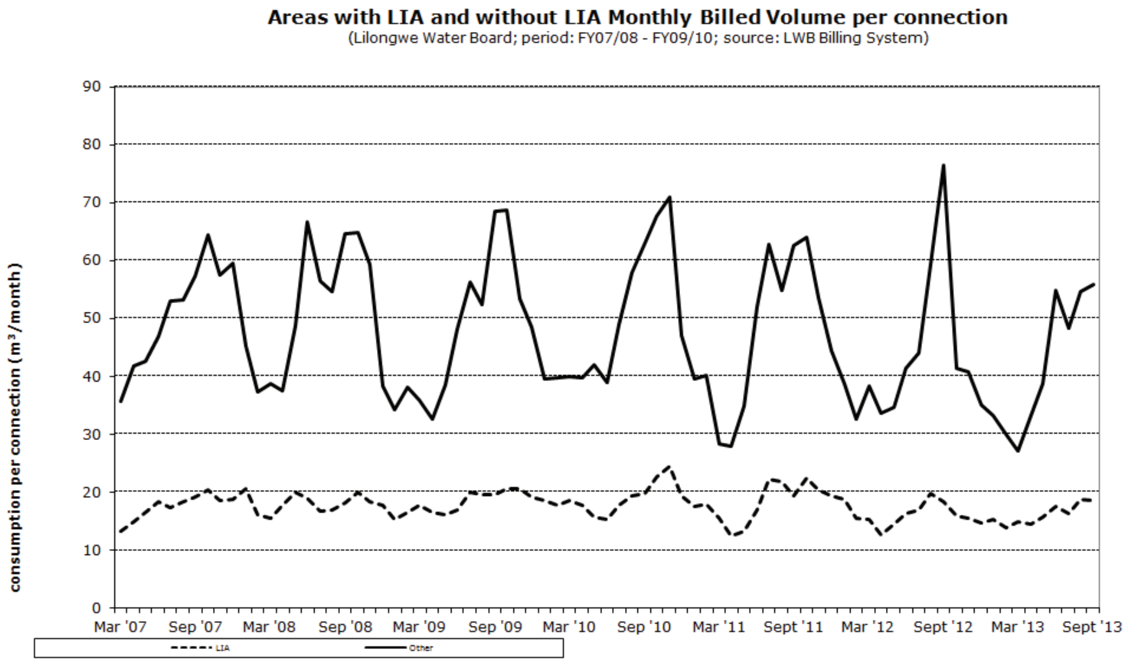

Figure 4.2: Average monthly consumption in LIA and in other areas

The consumption in areas without LIAs is strongly higher than the one in areas with LIAs throughout the years and it also shows a much more marked pattern of seasonal fluctuations, while LIAs consumption does not fluctuate as much, due to the fact that it corresponds to basic needs.

This difference is particularly important if we consider that shared connections are a reality in LIA, where the number of persons relying on each connection is much higher. Even, considering 8.8 persons per connection as indicated by LWB (VEI 2013) for the whole town, this means that in the areas including LIAs people consume a daily amount of 60 litres of water. This optimistic estimate is below optimal consumption levels for the WHO (Howard and Bartram 2003), so that no evidence of wasteful use of water can be found. Conversely the consumption level in other areas is too high, even if 100% metering is practiced.

The same EIB/WF project that financed the kiosks also foresaw the establishment of a so called *Access to Water Facility,* a micro Finance Fund to finance household water connections. The facility was expected to make 35,000 individual connections affordable for low-income customers in both Lilongwe and Blantyre. This was a very ambitious target if one considers that LWB had in 2013 about 45,000 connections. The idea was to provide credit for the connection cost (11,000 MKW at that time), allowing the customer to pay back in monthly installments.

Unfortunately the Access to Water Facility was never implemented. According to LWB PIU, LWB has a long backlog of clients who already paid but were never connected, also due to absolute water scarcity (demand exceeded supply since 2012 and they are now arranging for rationing). Moreover, according to the PIU it was not demonstrated if the reason why people was not getting connected was the affordability of the connection cost.

The issue was further explored with a key stakeholder of LWB, WaterAid, which confirmed that the demand for household connections in LIAs is high, but LWB is not doing connections accordingly, also because these areas are too difficult and costly to manage, even when land tenure rights are there. This is due to the fact that houses are one close to the others and that it is difficult even to understand the boundaries, which also impacts on all the costs (meter readings, bill delivery). Trémolet and Mansour (2014) report that, in the EIB/WF project, the set up of the revolving fund by LWB was optional because the EC procedures did not allow for grant funding being used for lending activities. Its implementation therefore relied on the ability of the Water Boards and the service contractor to leverage these funds. According to Trémolet and Mansour (2014), VEI made available 0.50 M€ and according to PIU more than 1.00 M€ was made available by the Government of Malawi, but the facility was not implemented.

As a matter of fact, the management of household connections is very challenging for LWB, with huge arrears in payments in both the wealthy and the low income areas. Massive disconnection campaigns were implemented instead in the recent years. Zone level staff, reported that in 2013 three disconnection campaigns were carried out. The third one had the duration of 25 days, and it had a target of above 20,000 disconnections. If this figure is compared with the number of active residential water connections for the same period (October 2013), which was just above 40,000, a clear idea of the proportion of these disconnecting initiatives can easily be achieved. It was explained also that disconnections campaigns target the high income areas first, because these areas ensure revenues from reconnection fees in a shorter time. Only after completing high income areas

LIAs are targeted, because poor households sometimes fail to get reconnected or they do it after a long time.

The reconnection fee was set at 3,500 MKW. This amount seems to be quite high and corresponded to more than 5 months of consumption for a basic consumption of 6 cubic meters per month. According to the Deputy General Manager LWB, the reconnection fee of MKW 3,500 includes both the costs of disconnection/reconnection and a penalty.

The average consumption at public kiosks in Low Income Areas was 16 litres per capita per day, considering 250 persons per kiosk (VEI 2013). This is a very low level of consumption, and it corresponds to "no access" in the terms of the WHO (Howard and Bartram 2003). However, the main strategy selected by LWB and its partners to achieve the project objectives in terms of access, following the idea of downscaling the ladders, is based on low cost solutions and public water kiosks for unplanned areas. The construction of 372 water kiosks was foreseen within the EIB/WF project, expected to serve more than 90,000 persons in low income areas, with 250 persons per point. This part of the project, as opposed to the one related to household level connection, was implemented.

4.3.3 Poor metering practices in LWB case

According to the research on LWB carried out by Chikasema (2009), there are a number of problems related to metering practices. Some of the most important problems are the lack of maintenance and replacement, the referencing system to locate the meters in the field and the slow and unreliable flow of information from metering to billing offices. According to the author, Lilongwe experienced a high increase in the number of meters with estimated consumption, which means that the bill is issued without a reading, based on estimations. In the study, the average number of meters with estimated consumption was found to be around 20%, with some areas above 40%. He also found a direct relation between the levels of Non Revenue Water levels and the number of meters with estimated water consumption.

In the most recent years, the intervention on metering was in fact associated to the objective of reducing NRW, a priority also within the EIB/WF project. At first, the main focus was on apparent losses (as opposed to technical ones), since it was expected that at least half of the total NRW was related to illegal connections and poor functioning of meters. Since 2011, out of a total of around 40,000 meters, 12,000 were replaced and the meters removed were recalibrated and reinstalled elsewhere. However, according to the PIU of LWB, the problem was not commercial losses, as the reduction of NRW achieved was far below expectations. Better results seem to be instead associated with the more recent adoption of the so called caretaker model and with bulk metering at the level of District Metered Areas – DMAs (Morrison 2004). This system allocates staff of different departments, both on the field and from the local and central offices, to specific geographic areas, to increase their accountability and commitment to the performances of that area.

The experience of LWB suggests that bulk metering proved to be more strategic than household level metering to address the challenges posed by Non Revenue Water rates.

4.3.4 Community participation and reselling regulation in Lilongwe

Table 4.4, coming from a poster in the Kiosk Management Unit (KMU) office, shows the number of water points managed in each Low Income Area or its sub-division, by type of management solution. The main solution for the management of public kiosks in Lilongwe is also consistent with the trends introduced above and it is based on Water Users Association (WUA) even if other organizational solutions, adopted in the past, still exist in some areas of the city. PPPs are managed by individual business people who entered in agreement with LWB straight. They were former staff of the LWB who were fired and compensated with kiosk licenses. This can be considered a residual category, as private sector management was refused by communities as a main strategy. LWB instead means that the kiosk is managed by the board straight, through its own staff.

Table 4.4 Number of Water Kiosks by Area and Management Entity

AREA	WUA	PPP	LWB	other	TOTAL
7		25			25
8		15			15
21		22			22
22A	8				8
22B			16		16
23		15		2	17
24	68				68
25		16			16
36			45		45
39			12		12
41	34				34
44			11		11
46	90				90
49			22		22
50 MGONA	16			4	20
50 SENTI	58				58
53			36		36
56	104				104
TOTAL	**378**	**93**	**142**	**6**	**619**
% on total	61%	15%	23%	1%	100%

Source: poster in the KMU office

Water Users Association (WUA) is the preferred option at present. In Lilongwe, WUAs started to emerge in the 2000s, with support from WaterAid and, as a result, a Kiosks Management Unit was established as an interface with the WUAs within the Water Board. According to WaterAid, there were eight WUA, including the ones under formation, in November 2013. A WUA is a private entity, registered as an association that enters into an agreement with LWB. WUAs are supposed to operate according to business principles and profits are allowed, while prices are regulated by LWB. WUA include elected members and members appointed by constitution from local elites: members of Parliament, traditional authorities, high ranking member of Christian and Muslim clergy, prominent business persons. The National water sector review, commenting about WUAs, states that they are "*a combination of a community based and a private organization*" and that their management structure has been critiqued as top heavy and costly (Malawian Min of Water, 2012). There is indeed a sort of elite capture which is intrinsic to the institutional design of these organizations. However, asked about the risk of captures, all the interviewed explained that when problems of legitimacy are posed by community members, they are easily solved thanks to the fact that the WUAs are registered and recognized by LWB. This is however a top-down legitimating and, as such, it is not fully consistent with participation principles.

According to the KMU, the extent of the maintenance tasks of the WUAs is limited to small pipes maintenance (<10 mm) and to the kiosks premises, while they report to the KMU for other problems. WUAs at present don't have any role in monitoring and controlling the household connection in their reference area. However, once the bulk metering installation will be completed, WUA are expected to become responsible even for household connections.

According to WaterAid, the expectation of LWB is that it might be easier to manage and extend household connections through the WUAs, "or at least it will be no longer their problem". Also WUAs are willing to do this because they think this will make them more powerful. However there are some constraints to be addressed. For example, according to WaterAid, users should still be responsible to LWB. According to the Deputy General Manager however, there is no risk associated to this change, at least on the part of LWB and WUAs are "*a way of outsourcing*" as "*they are not linked to us in anyway*" (KMU Manager). This inconsistency between the perceptions of the two parties reflects the tension between participatory and market oriented approaches already described.

At present reselling of utility water is not allowed in Lilongwe and the Waterworks Act (1995) indicates that it is forbidden[69]. However, according to the KMU Manager, disconnection of resellers is not much enforced *("when someone reports to LWB about reselling then we disconnect").*

The case of LWB shows that it is not easy to build sound bottom-up participatory solutions. It also offers an innovative case of community based management applied to household connections, while these experiences are usually limited to kiosks management.

[69] The definitions provided in part 1 of the water act actually provide a definition of "premises" which hardly apply to informal settlements and anyway exclude reselling by limiting the "service" to the identified premises. "Premises" includes any land, with or without buildings and any building, room, hut or shed which is held or occupied as a distinct or separate holding or tenancy. "Service" means all pipes, valves, cisterns, casks, fittings and other appliances through which water flows or is intended to flow after leaving the meter on any premises, and which are intended for the supply of water to such premises only.

4.3.5 Growing industrial demand in Lilongwe

LWB facebook published on 21th March 2013 that "*the water demand has completely outstripped production. (...). This is mainly coming in because of developments in Kanengo Industrial site, remarkable development in City Centre and other areas. The current production capacity can no longer be increased because of the water availability in the current source (Lilongwe River)*".

Total water demand exceeds production since 2012, and commercial and industrial consumption volumes accounted for 18% on average of the total demand, in the period between September 2012 and October 2013. In the peak period of November their share of consumption increases to 22%. The number of industrial and commercial connections is above 2,000, but area 29 alone, where big, mostly foreign business are concentrated, accounts for more than 20% on the total commercial and industrial consumption. According to the Malawi Confederation of the Chambers of Commerce, there are about 10 tobacco companies in Kanengo (area 29), while they were only 2 ten years ago. Other growing sectors are agribusiness, such as processing pigeon peas, soya beans, chilly and companies producing seeds varieties. Moreover, there are beverages companies and one company producing cotton. The average consumption per business in the whole city is 505 cm, per month while there are many users above 1,000 cubic meters per month, including agricultural business. These volumes are particularly impressive if one considers that the total monthly consumption from all the water kiosks in LIA is around 50,000 cubic meters.

There was a 7% increase in industrial and commercial consumption total volume between 2008 and 2012. The increase in the turnover of the manufacturing companies operating in Lilongwe fully accounts for the growth in the consumption levels, with around 59% growth in turnover in the same period (unpublished data from the Malawian Revenue Authority). However the absolute volume remains very high and it competes with domestic demand. This is being addressed by LWB, through pricing policy, as it is possible to see in Figure 4.3.

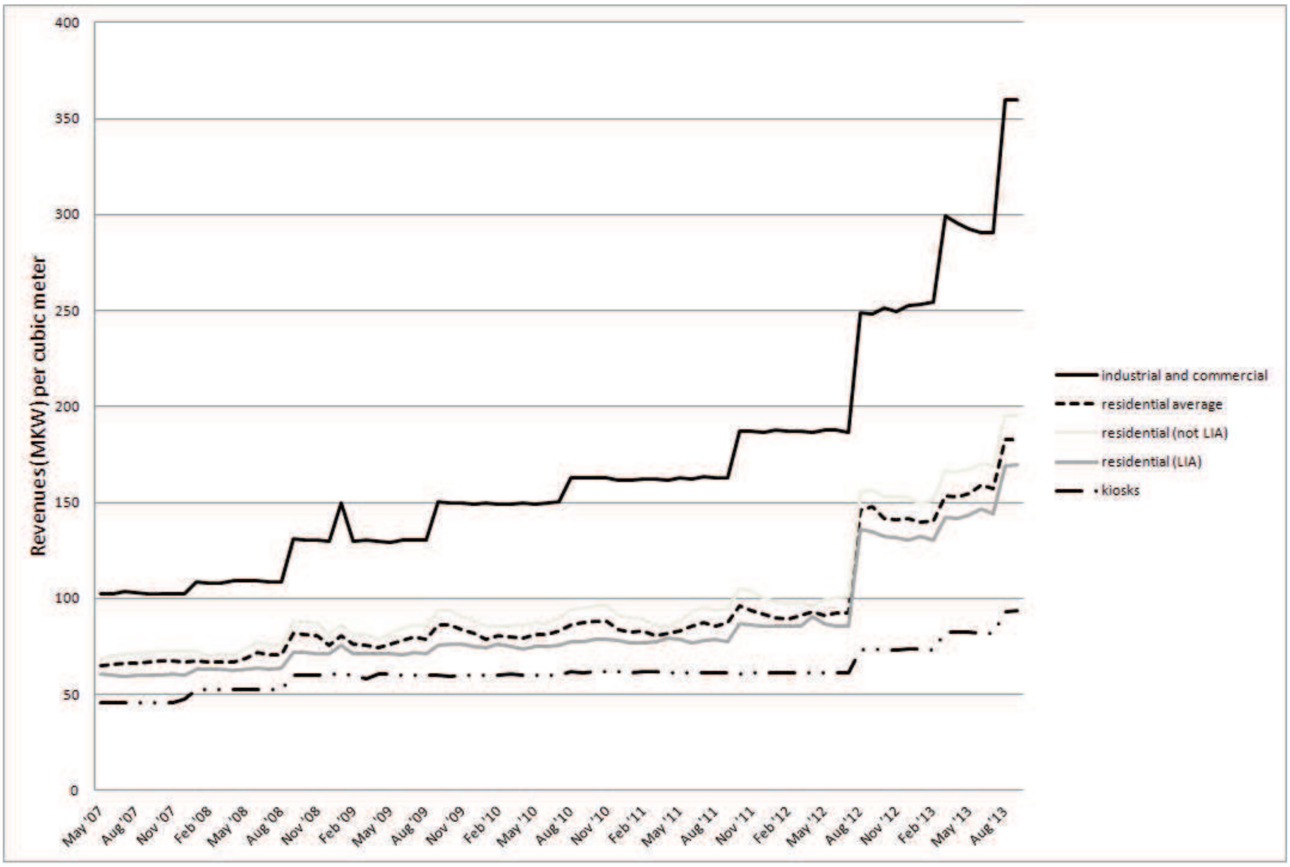

Figure 4.3: Unit revenues from customer categories (local currency MKW per cm)

The trend of the tariff system between May 2007 and August 2013 is characterized by a huge increase of the rates for industrial and commercial consumption, while for the average unit revenues from households and kiosks consumption the increase was less dramatic. However, insolvency by businesses (Simbota 2013) is partially jeopardizing the positive effect of the pricing policy. Industrial water pricing is not associated with any goal of broader economic policy (promotion of FDI, SMEs development,…) as, according to the Deputy General Manager, the constraint to industrial investment in Lilongwe is power costs and power availability, not water. Even if tariffs are increasing, they do not account for environmental costs. These costs are external to the LWB, because, as a matter of fact, wastewater is not treated and it remains unclear which is the responsible body for wastewater management. The Water Works Act (1995) states that Water Boards are responsible for sewerage, while the Local Government Act (1998) states that the Municipal Councils are responsible. At present in Lilongwe there is only one wastewater treatment plant and it is operated by the Municipal Council, treating a small share of wastewater produced. The plant is supposed to be transferred to LWB as soon as the Local Government Act will be emended. At present the sewerage service is not charged. The staff of the LWB office in the industrial area confirmed that to date "*it is problem of the city assembly to know where the* *industrial customers are discharging"*, also shedding some light on the advantages of this unclear situation.

About the possibility to develop lower quality raw water sources for industrial uses when the process standards allow it, it was explained by the deputy manager of LWB that some industries have private borehole but this is not very common. Concessions for boreholes are given by the Water Resource Board among the Ministry of Water but LWB has to confirm that the Board cannot supply the area where the concession is to be given. Moreover, in many places water is contaminated and in some places the water table is very low. Another reason for the provision of utility water to industrial customers, regardless the quality needed, can be found again in the words of the staff of the LWB office in the industrial area: "*We do not want to lose them: they are good customers"*. The experience of LWB with industrial customers shows an important trend of price increase, but not yet any serious attempt to reduce their consumption and environmental costs. Industrial water demand management could be improved. This can also be associated to the inceptives structure that was described in Chapter 2 that pushes utilities toward big volume customers, that ensures more cost recovery.

4.4 Conclusions

The analysis of the literature and of the case study provided some arguments against the opportunity of metering all household connections in poor areas of African cities. The main argument is related with the high cost of metering, including installing reading and billing. This cost, when compared with the benefits of metering each household, does not seem to be consistent. Complementary to that, it is argued that a service standard based on 100% metering, can prevent utilities from making household connections in poor, informal dwellings. Since increasing the number of users is an objective of both utilities and development agencies, often involved in the financing of metering programmes, this problem should be carefully considered.

It was pointed out that water demand management should prioritize non-domestic users, while the consumption by poor users does not need to be reduced and it is not very sensitive to metering. It was also shown that the operations of African utilities in the field of metering are not efficient and effective and this jeopardizes the potential benefits from metering. Systematic bulk metering instead seems to have more unexploited potential for the control of NRW. The high costs of metering and the complexity of the related practices were also considered and identified among the reasons preventing utilities from adopting a strategy of water access which is based on household level connection, regardless the widely recognized advantages of this solution. The analysis also pointed out the fact that household practising water reselling, informal providers and any association selling utility water have to be carefully metered, but also to be properly regulated. Metering alone in fact does not ensure that prices (and quality standards) to the end user are consistent with the utility requirements and informal providers and resellers need special, dedicated tariffs and regulation to avoid excessive mark ups or the transfer of high blocks tariffs to low volumes consumers (Boland and Whittington 1998).

As a matter of fact, most SSA cities are easily classified into better off areas and low income areas, often corresponding to the informal settlements, usually un-served or unevenly served. This marked spatial segregation allows for the adoption of different strategies by utilities, with universal household level metering only adopted for the wealthier areas.

For the low income areas, the point is not a dual alternative weather to meter or not the water flowing to those areas, which is instead necessary for leakages and Non Revenue Water control, but is where to place the last meter. Staddon (2010, p. 15) notices that "*there seems to be relatively little critical discussion of the optimal location for water meters or the optimal technology to deploy (...) it is simply assumed that these should be located at the service inlet to each and every house in the land.*"

If household level metering is reconsidered in favor of group metering, there is a chance to rehabilitate household level connections in LIA as a mean to ensure affordable and sustainable access to water to the poor.

Delegated management (among others WSP 2009) is already a good example of how it is possible to move the threshold of the utility responsibility upward to the level of the local small scale provider, identified as a market agent or as a community groups. Most solutions, however, assume that, even beyond the threshold of the last utility meter, the allocation of water will be based on the market, spreading the need to meter to each and every tap (WSP 2009). As a matter of fact, the management practices adopted in these cases are mostly market oriented, so that Page (2003) points at communities as "*agents of commodification*" referring to the role they can play in transforming water into a commodity. Similarly, Ahlers et al. (2013) challenge the idea that market forces can push small scale providers toward affordable and high quality services.

This is not necessarily the case if a wider variety of possible community arrangements are considered.

Collective metering, as proposed by Mara and Alabaster (2006) for in house multiple taps cooperatives, could be extended to yard taps, without jeopardizing the rational of the solutions proposed. Conveniently dimensioned groups of users can easily manage all the challenges that typically prevent water utilities from connecting users in low income areas, from overconsumption to high turnover of dwellers, from illegal reselling to arrears in the payments.

Group connections can also overcome the problem pointed by Boland and Whittington (1998) of the regressive effect of increasing block tariffs in case of shared connections. This problem is in fact overcome by rescaling the ceiling of the basic consumption block in order to account for the number of users relying on the connection.

Moreover the lower the number of meters, the higher the accuracy that the utility can assure for their testing, functioning and reading.

It can be noticed that these solutions are similar to what already happens in western urban areas, and sometimes even in African cities' centres, with connections of condominium buildings, or in poor neighbourhoods with shared connections. The main difference is that the number of users should be higher and their internal relations should be regulated. Group connections should not require any land tenure over the plots supplied, nor conversely imply any title over the plot by the individual joining the group, thus overcoming the challenges related with coordination among different bodies, mentioned as a constraint by Dagdeviren and Robertson (2008).

The study has shown that metering at household level can be too complex and costly to manage and that alternatives can be explored to reduce costs, without scaling down the supply ladder and keeping the domestic demand volumes controlled.

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4.6 Appendix A: checklist used for semi-structured interviews

Individual Connections, meters and households reselling

- *Is the foreseen AWF (Access to Water Facility) for Low Income Areas (LIAs) working in Lilongwe?*
- *The reconnection fee is currently set at 3.500 MKW. This amount seems to be quite high and corresponds to more than 5 month of consumption for a basic consumption of 6 cubic meters per month. Could you comment of this? Does the amount of MKW 3.500 correspond to the variable cost of reconnection or is it a disincentive late payment/no payment? Can a detail of such variable costs be provided? What does the experience of recent disconnections suggest about the affordability of reconnecting?*
- *Do you want to share any comment about the recent (or still ongoing?) disconnection campaign?*
- *According to LWB annual report 2011-2012, meters are the 4th asset of LWB in terms of value (notes to the financial statements p. 42) but their estimated useful life is 5 years only (p. 35) while for other assets the depreciation time horizon is much longer. Can you comment on this? Does this mean that meters costs are to be recovered in a shorter period and boost water bills?*
- *Were prepaid meters adopted in any area in Lilongwe? And in Blantyre?*
- *Were boundary meters (bulk meters) installed, as suggested by WaterAid (WaterAid 2007)?*
- *Was any alternative to metering at the household connection level considered (i.e. flat rate combined with metering and regulation for reselling households) ?*
- *Was any regulation of households reselling practices introduced?*

Water Users Associations and Kiosks Management

- *Which is at present the proportion and number of kiosks managed by WUA and other solutions respectively (committees, privates operators, privates under WUA contract)?How many WUA are currently operating? Which is the Max, Min Average number of kiosks managed by each WUA?*
- *Both Chirwa (2007) and WaterAid (2007) report the widespread experience of "captured" water kiosks, referring to these situations where community committees and community based organizations supposed to manage kiosks, were substituted by members of local elites, in most cases with important mismanagement outcomes (prices increases, poor maintenance, arrears). Is there any device preventing WUAs to be captured as it happened with the former committees?*

- *Which is the Government Office which registers the WUAs? Is there any recognition by the Ministry of Irrigation and Water Development? Which are the criteria adopted by the LWB to enter into agreement with a WUA?*
- *Is there any device ensuring that there is one single legitimate WUA per area?*
- *How is the membership base of WUAs defined? Is there any device to ensure that any user can apply or that the whole users community is conveniently represented? How is a WUA accountable to the reference community?*
- *Which is usually the precise extent of the maintenance are of WUAs (i.e. downstream a gate-valve, a given number of kiosks,…)? Does it cover taps and kiosks only or is it also supposed to cover the distribution network in the area?*
- *Do WUAs have any role about the monitoring and controlling the household connection in their reference area (reselling, meters tampering,…)?*
- *Which are the main contributions, in terms of expertise and solutions, provided by VEI to the issue of kiosks management in LIAs?*
- *How is the price charge by kiosks regulated? How is it the regulation enforced? How is the bulk tariff for community water kiosks calculated? Is it an O&M cost recovery tariff? How does the possible transfer of O&M responsibility (and related costs) over kiosks affects the calculation?*
- *Is any regulatory function covered by the Ministry or by the Water Board? Which is the body in charge of price regulation?*
- *Which is the nature and the role of the Kiosk Management Unit?*

Commercial and Industrial Users

- *Was any limitation to the growth of industrial demand considered?*
- *Was the possibility to develop specific raw water sources considered for industrial uses (low quality sources, when the process standards allow it, or private boreholes)?*
- *Why was a flat rate tariff for industrial/commercial users selected? Is it a capital cost recovery tariff?*
- *Are treatment costs considered? And environmental costs? How is the problem of industrial wastewater treatment addressed?*
- *Was the possibility of price differentiation between industrial and commercial users considered?*
- *The previous tariffs set the ratio between the highest block of domestic consumption and industrial commercial consumption at 245/160 (1.53), while with the new tariff the ratio is*

352/202 (1.74). Which is the reason for this increase in the industrial/residential tariff ratio?

- *How are the volumes of industrial consumption changing?*
- *Which kind of industries are being attracted in Kanengo Industrial park? Are they operating water intensive production processes?*
- *Is industrial water pricing associated with any goal of broader economic policy (promotion of FDI, SMEs development,…)? If yes, which is the Central or Municipal Government body which formulates these goals and transfer them to the Water Board level?*

4.7 Appendix B: game theory and household consumption

The appendix presents some possible implications of shared meters in term of the consumption behaviour of households and their cooperation strategies.

Moving the meters upstream, with a number of poor households using the same meter, poses problems of free riding and cooperation. More particularly, in the terms of the game theory, each household faces up to the decision whether to over-consume or not, and with uncertainty about the consumption of the other households, or, to simplify, about the average consumption of the other households (Table 4.5).

Table 4.5 Household consumption game

		Average household	
		Normal consumption	Over consumption
household A	Normal consumption	Cooperation	Quasi tragedy of the commons
	Over consumption	Free riding	Tragedy of the commons

Source: personal elaboration

The incentives to free riding and opportunistic behaviours basically depend upon two variables: the penalty for overconsumption (difference between the first block tariff and the tariffs for consumption above this ceiling) and the dimension of the group (number of households using the same meters and entering a contractual relation with the water utility jointly) that is going to pay the penalty. The higher the penalty for over-consumption, the lower the incentive to over-consume and free ride. The higher the number of households, the higher the share of the overconsumption costs that each over-consuming household can externalize.

With realistic values of these variables however, in a single simultaneous game free riding cannot be avoided and it will result instead as the dominant strategy, because each individual is confronted with the same game structure. If all the households opt for free riding and over-consume, however, the result will be the lowest right cell (Table 4.5), corresponding to the lowest total pay off.

The tragedy of the commons however is not necessarily the case, as the game is not simultaneous and it is not single. As a matter of fact, users can monitor the total consumption and the average consumption of their fellows during the months and adjust their behaviour accordingly. Moreover the game is repeated because the decision takes place every month and people can learn how to cooperate (Ostrom 1990). Further research could provide some reference values for the dimension of the groups and the penalties to be applied even by using more formal applications of the game theory or agent based models.

5 Conclusions

5.1 Some general considerations on the neoliberal reform in Sub Saharan African water industry

The study provides some insight on three important issues: cost recovery policies, private sector involvement and household level metering in the framework of the neoliberal reform. While cost recovery policies and private sector involvement are clearly related to broader issues of political economy, metering belongs more closely to the space of technicalities. The study does not provide a comprehensive evaluation of the neoliberal agenda for the water sector, but it contributes to the understanding of the new public management approach to water supply sector in Sub Saharan Africa, which nonetheless includes recommendations not addressed in the present work like accountability, consumer and market orientation of the water utilities.

The three issues studied are among the recommended recipes for African water utilities, while none of them belongs to the most extreme neoliberal agenda. They instead form a legitimate part of a softer set of tools which gained, or kept, momentum, after some failures and shortcomings of the reform model became apparent. These, and other New Public Management style approaches, are often presented and perceived as less politically biased. Their justification is nonetheless derived from market oriented arguments that closely resemble the ones that justified the introduction of their harder counterparts. Moreover, the logical links between interventions and expected results are sometimes more smoothed and unclear.

Harder policies had ambitious objectives and promised important welfare gains for everybody. Access to water was expected to improve as a consequence of full cost recovery and private investments; efficient allocation of water was expected from prepaid meters. The policies here analyzed have more modest ambitions. While they recognize that the African water sector cannot ensure profits and nether the recovery of capital investments, so that access improvements will not come out of cost recovery policies, yet a great effort is still put into them. While it is clear that no free lunch will result from private sector investments in water infrastructure, it is still considered strategic to involve private actors, even if public finance has to pay the bill. While pre-paid meters ensure that there is no waste of water at the cost of jeopardizing access, billed metering leaves some space for wastage (if bills are not properly issued, delivered and paid) and it can still prevent access.

In table 5.1, the three topics analyzed in this work are indicated at the top of the columns. Their harder counterparts with their ambitious objectives and the reasons for their failures are summarized in the first rows. The revised objectives and the shortcomings presented in this study are instead recalled in the second part of the table. Lastly, the alternative technical devices recommended in each specific chapter are presented in the final rows, jointly with their theoretical and ethical foundations.

Table 5.1: Synoptic framework of the reform trends on the issues studied

		Cost recovery	**Low risk PSI**	**Household level metering**
Harder neoliberal recipe	**Problem to be addressed**	Inefficient SOE lack of investments		Water demand management and opportunistic behaviours
	Harder variant	Full cost recovery (plus profit)	Concessions, lease, affermage	Pre-paid meters
	Reason for failure/criticism	Difficult to achieve full cost recovery mostly for affordability problems	Lack of investors (see cost recovery)	Public health and human rights concerns
Recipe studied	**Objective**	Financial sustainability of operations plus substantial contribution to urban infrastructural investments	Efficiency gains by utilities	Efficient allocation of water
	Shortcomings discussed in the present work	Misleading incentives for access increase	Low efficiency and (aid) effectiveness	High costs preventing access
Alternatives	**Alternative devices recommended by the study**	Financial sustainability of operation	No promotion of PSI	Collective metering
	Foundation of the alternatives	Public finance	Public ethos	Civic ethos

Looking at the foundations of the alternatives proposed by the study, it may be thought that the alternative suggestions are based on overoptimistic assumptions on how the real world actually functions, but this is not the case.

Public finance could afford the costs of 17 billion dollars needed from 2009 to 2015 to reach the water MDG (Banerjee and Morella 2011), and even the double amount, required to bring the proportion of people without access to safe drinking water sources to zero, as it represents only around 5%[70] of the military expenditure of the USA alone. Public and donor financing can afford this cost, even if they bring in some challenges which should be recognized and addressed. The possibility of financing water infrastructure from fiscal revenues is limited by the small dimension of the tax base in African economies, but positive trends can be detected both in the absolute value of revenues collected, related to the fast growth of many African economies, and in their value as a percentage of GDPs (AfDB 2010). Public financing can also be based on borrowing by sovereign and sub-sovereign public bodies, like municipalities. The cost for the latter however can be prohibitive in the absence of guarantees by the central government (Winpenny 2003). ODA financing can be associated with dependency and corruption (Moyo 2009), conditionality and low

[70] Computation based on Stockholm International Peace Research Institute for 2008 (http://www.sipri.org/research/armaments/milex/milex_database)

predictability (Bulíř et al. 2008), and it is not yet clear how the increasing presence of new donors from emerging countries can modify the picture.

Public ethos, at the level of institutions, instead proved to be an issue to be addressed ineludibly, regardless the willingness to introduce Private Sector Involvement (Budds and McGranahan 2003, Estache and Kouassi 2002). In the framework of the present study this was also confirmed by the key role played by public utilities in light PSIs. Moreover, transparent and committed public regulation is recognized to be of utmost importance when the private operator has a higher degree of autonomy.

Lastly, the problem of civic ethos, at the level of individuals and society, is about the ultimate nature of human beings. Deviations from the paradigm of economic rationality and individualism are well known in the management of common goods particularly (Ostrom 1990) and it can also be promoted by purposely designed institutions. For sure both the *homo economicus* and the cooperative one need water, and solutions to satisfy this need should avoid ideological biases.

The three analysed recipes share an ultimate instrumental nature, and, as such, they should be assessed, adopted, improved or rejected, in relation to the results they deliver. The study provides some results that are here recalled.

5.2 Cost recovery and access

The second chapter focuses on the problems of cost recovery and access to drinking water in Sub Saharan Africa. An econometric model explaining the dynamics in water coverage which accounts for financial performances of utilities is proposed. The data set covers 25 countries in the Sub Saharan region from 1995 to 2012.

The econometric analysis demonstrates the importance of cost recovery, as the cost recovery indicator has always positive significant coefficients, but the square of the same indicator, which is significant in most cases, has a negative coefficient of comparable dimensions. This emphasizes the negative effect of higher levels of cost recovery. Therefore, cost recovery positively contributes to improve the coverage up to a certain value, by reassuring governments and donors on the sustainability of the utility itself or even by providing some funds from financial margins to complement public and donors' funding. Beyond that value this positive contribution is no longer observed and the coverage change gets lower or even negative.

Good financial results do not necessarily translate into corresponding increases in coverage, providing some empirical support to the warnings from descriptive studies: if utilities are urged to achieve financial results they might fail to provide water services to low income customers. For example, the high tariffs and high connection charges which are made necessary by high cost recovery targets, can push low income customers toward water sources other than utility, often unprotected and unsafe, adversely affecting the coverage (among others Dagdeviren 2008, Bakker et al. 2008, Bayliss 2011, Hall and Lobina 2012). Similarly, overemphasizing the importance of financial results can push water operators toward big volume customers who ensure high consumption levels with small investment in distribution, while disregarding the demand expressed by African poor households (Bayliss 2011, Bakker et al. 2008). Poorly designed cost control or cost reduction strategies can result in the delay and reduction of maintenance interventions, driving decreasing social returns of cost recovery, as the access rates, even in previously served areas, decrease, because operation and maintenance expenditures are too low (van Ginneken et al. 2011).

The results have important policy implications about the opportunity of setting high cost recovery targets for utilities. This is often done by regulators or by donors and international agencies setting targets for performance contracts or in the covenants for soft loans and grants. High targets can be misleading and they can introduce perverse incentives for utility managers. In order to provide some reference values which should not be exceeded, the point where the quadratic function changes its slope can be taken as a reference. The results are between 1.1 and 1.2, higher than the recommendations from the literature (GWI 2004, Tyman and Kingdom 2002, Banerjee and Morella 2011), which are between 1.33 and 2.

As the value of 1 corresponds to the complete recovery of operational and maintenance costs only, it is also possible to confirm that these costs should be possibly recovered by utilities through tariffs. In all the models proposed, the descending part of the curve started above the value of 1 O&M cost recovery can thus be associated with positive changes in access.

Other positive recommendations arising from the study for utility managers seeking to increase the coverage are that the infrastructure maintenance should never be neglected and that a certain reliance on public and donors funding should not be blamed, given the huge task of increasing coverage in cities with a rapidly growing population.

Sustainable cost recovery can be part of pro poor strategy aiming at expanding the access, based on cross subsidy among users categories and on tax and transfer finance. A reasonable level of cost recovery in fact makes utilities more bankable and reliable for donors and allows them to maintain their infrastructures properly. On the contrary, if cost recovery is not intended as a part of a pro poor strategy, it can become a part of the water access problem. If financial performances are not intended a means to increase water access and they become an end as such, this will adversely affect the results that they were supposed to pursue.

Cost recovery can keep its place in the tool box of reformers, but it should not have a legitimate autonomous role in the reformers agenda. This agenda in fact should focus much more strictly on access priorities and should adopt a broader set of tools to address them.

5.3 PSIs and aid effectiveness

The third chapter refers to the Light Private Sector Involvement initiatives, considering efficiency improvements, aid effectiveness and related policy implications and analyzing the determinants which can incentive or discourage the partners of light forms of PSI initiatives to achieve the expected results or to engage in the contracts. This is done through a review of case studies from literature and from original fieldwork, involving management and service contracts, which are the lightest and lower risk forms of public-private partnership. The incentives to perform for both the private and the public partner, as determined by the contracts and by the wider context are considered. The incentives necessary for both parties to engage in the partnership are also analysed, jointly with the costs of creating these preconditions. The review of the case studies contributes to explain why low risk PSIs tend to deliver limited efficiency gains to the utility and shows that the costs associated to the contracts are disproportionally high.

Low risk PSIs are the result of a compromise between the resistances of utilities, civil society and governments against the private sector and the reluctance of the private sector to take on risks. Also the expectations posed on private sector were reduced. The low risk PSIs have proved to be acceptable for both the public and the private actors involved, but they were then characterized by important shortcomings and high costs. The balance between risk reduction and performance incentives has proved to be delicate, as the reduction of some risks causes a reduction of the incentives to perform and generates substantial costs. At the end, the PSIs succeed to engage the actors from both parts, but they fail to ensure that performances are in line with expectations.

High shares of the contract value are usually tied to performance, but contracts are incomplete and computation of the KPIs is often questionable, while performances are sometimes out of the control of the operator itself. A narrow decision making space for the contractors was also found to be a common challenge, but at the same time the restriction of the contractor's role is intrinsic to light PSIs and necessary to overcome political resistances. In the bidding phase, competition for the market was low, with few bidders, in the earlier case studies; while compensation for the bidding effort was recognized in later cases. Utilities have no incentives to cooperate with the contractors and the resistances are widespread. Light PSIs fail to make the private sector more acceptable for utilities, but in turn, by reducing the autonomy of the private operator, they make the cooperation of public utilities critical to the success of the partnership. A stronger alignment of formal incentives for the contractor and for the utility was thus advocated. This, however, would further increase the complexity of the contracts design and the transaction costs, if incentives for the utilities are not part of a wider regulatory framework. In turn, a well functioning regulatory framework should be considered a priority as such, and not only a precondition for PSIs.

The contracts considered in fact have disproportionally high transaction costs, particularly if the limited results from these PSIs are recognized.

The PSIs analyzed are characterized by devices to reduce or remove exchange, inflation and regulatory risks faced by the contractor. Furthermore, more devices are invocated by observers when any element of the local institutional and market context challenges the smooth implementation of projects. This, however, poses the operator in unrealistic settings, so that it is impossible to know if efficiency gains would be sustainable in real world settings. By jointly considering the poor performances, the uncertain role of contractors to achieve them and the facilitating devices, the accountability for the results of light PSIs seems questionable. As accountability for results is among the principles of Paris and Busan (OECD 2005 and 2012), this challenges the Aid Effectiveness of low risk PSIs.

Light, low risk PSIs cannot be recommended, but this does not automatically mean that higher risk PSIs should be rehabilitated. If PSIs could be seen as a last attempt to realize Private Sector Involvement, the failure of the last attempt should virtually imply the recognition of a wider failure of any form of PSI. However, all forms of PSIs are still promoted and evolving in many directions, but the study can provide a conclusion which is valid for any form of PSI.

"Rushing and pushing" (Dagdeviren and Robertson 2013) private sector involvement when none of the actors is willing to engage in these experiences has perverse and contradictory effects. This paradox was particularly apparent for light PSIs, due to the low expectations and low results and to the high transaction costs, but this can be the case for any form of PSI. Forcing PSIs is not in line with the principle of ownership of the Paris declaration: "partner countries exercise effective leadership over their development policies, and strategies and co-ordinate development actions" (OECD 2005 p.3).

PSIs should be implemented only when they are perceived as a need by the beneficiary utility, the local institutions and civil society, and they should not be related to any implicit or explicit conditionality. This would make the complex architectures to persuade the public sector, reduce risk and attract the private sector useless. PSI is costly and diverts attention from key priorities of the SSA water sector, like the need for increasing coverage and alternative strategies to make financing available. In conclusion, PSI should not be considered a priority as such if the Aid

Effectiveness in the water sector, in line with the objectives of the international community, has to be increased.

According to Van Dijk (2014) the debate on PSI has moved from "against privatization" to "ok but under which conditions". The study contributed to clarify the meaning of "under which conditions"- This should not mean that conditions must be created at any costs but that in many cases conditions are simply not there and PSI should not be introduced.

5.4 Household level metering and the drinking water ladder

The chapter analyses the priorities and tools for Water Demand Management in urban Africa, focusing on household level water metering. The study presents an analysis of the issues associated with water metering at household level by utilities in low income areas or informal settlements of Sub Saharan African cities. Metering is considered a key tool for water demand management and recommended as a good practice in the water supply sector but, while its benefits are clearly spelled out by donors and development agencies, its costs and shortcomings are seldom considered. The paper analyses such challenges, based on the available literature and on an original case study on Lilongwe Water Board (Malawi) and provides some arguments against the opportunity of metering all household connections in poor areas of African cities.

It is pointed out that water demand management should prioritize non-domestic users, while the consumption by poor users does not need to be reduced and it is not very sensitive to metering. It is also shown that the operations of African utilities in the field of metering are less than efficient and effective and this jeopardizes the potential benefits from metering. The high costs of metering and the complexity of the related practices are also identified among the reasons preventing utilities from adopting a strategy of water access which is based on household level connection, regardless the widely recognized advantages of this solution. The analysis also points on the fact that household practising water reselling, informal providers and any association selling utility water need to be carefully metered, but also to be properly regulated. Metering alone in fact does not ensure that prices (and quality standards) to the end user are consistent with the utility requirements and informal providers. Moreover, resellers need special, dedicated, tariffs and regulation to avoid excessive mark ups or the transfer of high blocks tariffs to low volumes consumers (Boland and Whittington 1998, Gerlach and Franceys 2010).

It is pointed out that participatory approaches are sometimes biased toward market based solutions (Page 2003) and the appeal of business opportunities can be among the reasons for frequent elite capture of grassroots institutions. If household level metering is reconsidered in favor of group metering, there is a chance to rehabilitate household level connections in LIA as a mean to ensure to the poor affordable and sustainable access to water. For the low income areas, the point is not a dual alternative weather to meter or not the water flowing to those areas, which is necessary for leakages and Non Revenue Water control, but is where to place the last meter, challenging the assumption that this should be located at the service inlet to each and every house. Group connections can also overcome the problem pointed out by Boland and Whittington (1998) of the regressive effect of increasing block tariffs in case of shared connections. Moreover the lower the number of meters, the higher the accuracy that the utility can assure for their testing, functioning and reading.

The study has shown that metering at household level can be too complex and costly to manage and that alternatives can be explored to reduce costs, without scaling down the supply ladder and keeping the domestic demand volumes controlled.

Metering is only a minor part of the water supply technical paradigm and the role of other parts, probably even more strategic, could also be discussed, as the dominance of centralized water supply systems (Lobina 2012). Metering however is strictly associated with commercialization oriented reforms of water utilities and was given a high priority in the framework of cost recovery and of water demand management goals. Metering, in this view, can be seen as a tool for cost recovery, which should also be a tool itself. In this case the shift of priorities is thus double: metering became a priority as such, regardless its consistency with the social objectives that the cost recovery is supposed to purse. Again, the study advocates for a resetting in priorities, where every tool can give its legitimate contribution but can be even rejected. Technologies should be appropriate (Schumacher 1973) to purse the goals associated with existing social pressing needs, in the specific context, not vice-versa.

5.5 Closing remarks

All the devices analyzed in the study have probably some potential for the improvement of water services, provided that they are conceived as instruments to achieve explicit social and welfare objectives and not as final goals, such as it is often interpreted by IFIs and donors. The importance of focusing on water access objectives, by distinguishing more clearly between means and ends, has already been pointed out by different authors. For example, Dagdeviren (2008 p. 117), referring to cost recovery policies implemented among Zambian commercialized utilities, stated that "*while reforms for improving service provision are welcome, it is important to focus on the compatibility of the means and ends in the process of implementation*".

Bayliss (2009) highlights that sometimes the reform is interpreted as a given, standard recipe, and the region is evaluated in relation to its ability to conform to the reform. Reform proposals should in turn be evaluated against their suitability for the existing environment. This paradox is apparent when the words of Marin (2009 p. xi), commenting that Sub-Saharan Africa is *"a challenging region for reform*", are considered. In fact, the recognition of the access to water as a human right by the United Nations in 2010 calls for a stricter focus on the social and welfare objectives of water supply, which is also advocated by the present work. Recent outbreaks of communicable diseases, like Ebola, in the Sub Saharan region should also make clear that water access is not a negotiable priority and that the implications of public goods externalities cannot be ignored.

The enthusiasm for the Washington Consensus largely accounts for the genesis of the inversion of priorities observed in the '80s, as policies were oriented towards privatization and the reduction of public expenditure and there was the expectation that the resulting economic growth would have benefited also the poor. In developing countries this also corresponded to the structural adjustment which followed the debt crisis of the '80s. The Augmented Washington Consensus (AWC) accounts instead for the increased focus on the role of institutions, that more recently has resulted in corporatization and commercialization, and in NPM style policies (Rodrik 2006, Schouten 2009). These agendas however survived the recognition of some failures and after the end of the era of unconditional trust in neoliberalism. For example, to mention a criticism that, *mutatis mutandis*, can also apply to the water sector, a narrow focus on efficiency gains was recognized to be a poor substitute for a sound growth strategy (Rodrik 2006, World Bank 2005).

It is worth spending some final words on the role played by the development community in this context in the African water sector.

African countries often lack the human resources and the autonomy to invest in the development of their own original solutions, and therefore tend to accept technocratic solutions, brought in by donors and practitioners. These last actors in turn have a certain inertia and, as noticed by Rodrik (2006, p. 1) in the context of broader development recipes derived from the Washington Consensus, *"life used to be relatively simple for the peddlers of policy advice in the tropics*". The development community adopted, recommended and translated into practice the tenets of the neoliberal ideology even beyond the implications of the Washington Consensus. In fact, the recipes of the Washington Consensus, regardless of their actual effectiveness, were intended to achieve economic growth, which clearly is not the main goal of water sector policy. A similar inconsistency is pointed out by Bayliss et al. (2011) who question the legitimacy of the priority attributed to Private Sector Development within water sector programs. Private Sector Development was officially endorsed by the World Bank (2002) as a cross cutting strategy, to be declined also in water sector programs. However, there is no theoretical support to the idea that water services development should promote private businesses, regardless their nationality and dimension, nor empirical evidence that this can have an impact on the local economies. Moreover, it should not be forgotten that the Washington Consensus relaxes its austerity dogma in the case of public spending in strategic sectors, like water services. Williamson himself (1989) advocated the reorientation of public spending from subsidies toward broad-based provision of key pro-growth, pro-poor services like primary education, primary health care and infrastructure investment. Nevertheless, these exceptions to the basic rule remained largely unattended and neglected (Rodrik 2006).

The present work emphasizes the importance of social objectives of water supply interventions and the importance of the ownership of the reforms by local, possibly re-empowered, institutions. The work calls indeed for a serious reconsideration of the water sector policies and of the utilities reform agenda. While the focus on the water access objective should be more stringent, the tools box adopted should be more flexible and it should be broadened.

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