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Providing water services at scale: how to move from unsustainable assistance to sustainable development?

Christelle Pezon

IRC Associate, 23 bis rue Rougas, 34800 Clermont l'Hérault, France. E-mail: christelle.pezon@laposte.net

Abstract

This article presents the results of a study of water service performance in four small towns in the Sahel Region in Burkina Faso. It shows that water supplied via small piped water systems to tap stands is cheaper per user than water supplied via hand pumps as well as providing better quality service. The comparison of life-cycle costs highlights that the cost of supporting the organisation and management of hand pump services disqualifies this type of access on an economic level. Furthermore, comparison of the levels of service actually delivered to the people shows that piped water systems meet the demand and can have a positive impact on development, whereas hand pumps are part of a survival-oriented approach that is dependent on international assistance.

Keywords: Burkina Faso; Life-cycle cost; Rural water supply; Water service delivery

1. Introduction

The past decade has been marked by rapid urbanisation. This historical phenomenon takes various forms. In areas usually considered to be rural, small towns are springing up and the technology usually associated with urban areas is seeping in. This is also happening in the water sector with the construction of thousands of small piped water systems in semi-urban centres of a few thousand inhabitants which supply public tap stands or even households, with private connections on the premises. The past decade has also been marked by the increasing decentralisation of responsibility for water and sanitation services to the local authorities. In West Africa, public service delegation is usually the favoured management choice for these systems, and this has spurred both market development and the emergence of private operators.

Despite being landlocked and predominantly rural, Burkina Faso (population 16.5 million) is no stranger to this trend. Today, 77% of Burkinabe people live in rural areas and half the urban population lives in the capital, Ouagadougou. But the rural environment has changed. Since 1985, the number of villages with fewer than 200 inhabitants has halved. In 1985, two out of three villages had fewer than

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1,000 inhabitants whereas by 2006, half boasted populations of more than 1,000. In 2006, 60% of rural dwellers lived in 'villages' of more than 2,000 inhabitants, half of which were small towns of 5,000–10,000 people. By 2050, the urban population is predicted to be either equal to the rural population (22–24 million), or to be double their number (33 million in urban areas as against 16 million in rural areas) (Ministère de l'Economie et des Finances; MEF, 2009).

For the past 10 years, the type of water access available to villagers and the inhabitants of small towns in Burkina Faso has changed. Villages with populations of more than 3,500 are now equipped with small pressurised piped water systems which supply water through tap stands and a few on-the-premises connections for private households. These systems supplement the service hitherto provided by hand pumps. Hand pumps remain the only improved water source in villages of fewer than 3,500 inhabitants and are managed by community structures (Water User Associations (WUA)). In small towns, hand pumps will remain managed by a WUA, while town water will be managed by an operator (privately owned or an association). In the Sahel Region of Burkina Faso, all the piped water systems are managed by the same operator, FasoHydro.

In theory, pressurised water supply should offer a better quality service than hand pumps. Tap stands should bring water closer to the people or even to the home (on-the-premises connections) and supply a smaller number of users (120–170 users per tap) than hand pumps (300 users) (Table 1). As the price is linked to the expected level of service, water at a tap stand is much more expensive than at a hand pump. A user must pay the equivalent of 500 FCFA per m^3 (1 US$/$m^3$) when collecting water at a tap stand whereas an annual contribution of 250 FCFA per person per year (0.5 US$/p/y) is required to access a hand pump.

Are these piped water systems delivering the expected level of service? Is there a demand for this type of access? Does it actually deliver a better level of service than the hand pumps? Is it sustainable? Should piped systems be built at considerable cost ($125,000 on average per network according to the Water Resources Directorate) in smaller villages (2,000–3,500 inhabitants) or should the installation of pumps continue? In small towns where piped water systems have been constructed, what should be done with the boreholes that have hand pumps? Should they be closed off? Should those that are broken down be repaired?

The rate of piped system breakdowns (23%) (Ministère de l'eau, des aménagements hydrauliques et de l'assainissement; MEAHA, 2014) gives warranted cause for concern. In Burkina Faso, the demand for water is said to be too low and the price of water at tap stands too high. The pricing policy is said to be hindering the construction of piped systems. It is believed that as the critical mass cannot be reached, it would be risky to envisage gradually reducing the price and/or increasing accessibility including to the poorest, by extending networks and increasing the number of private connections.

This study proposes to measure and compare the cost and quality of service delivered at each stand pipe and hand pump in four small towns of Burkina Faso. How much does each type of service cost per

Table 1. Water access indicators for hand pumps and tap stands.

	Quantity	Quality	Distance	Crowding
Access to service	> 20 l/c/d	In compliance with WHO standards	TS ≤ 500 m HP ≤ 1 km	PC ≤ 10 c/d HP ≤ 300 c/d TS ≤ 500 c/d

TS: tap stand (three or four taps per stand); HP: hand pump; PC: private connection; c: capita; d: day; l: litres.

user? Is the level of service offered by piped systems actually of better quality? How can the most effective type of access be developed further?

2. Burkina Faso and the towns studied

Burkina Faso is one of the poorest countries in the world. In 2013, Gross National Product per capita was 336,000 FCFA (less than $700) and 44% of the population lived below the poverty line, set at 108,454 FCFA per year ($0.62 per person per day). Life expectancy is lower than 55 years and 71% of the population has no education. In terms of human development, the country is classified 161st out of 169 (Institut National de la Statistique et de la Démographie; INSD, 2012).

According to the Joint Monitoring Programme, Burkina has achieved its development objective in terms of access to water: 80% of the population has access to an improved water source, 6% of which is in the form of household connections and 73% through tap stands, hand pumps or protected wells. In terms of service quality, Burkinabes are at the bottom of the ladder: while in Africa 13% of rural populations have a water supply on the premises, this figure is only 2% in Burkina Faso, which is very low, even with regard to the average for West Africa (5%) (African Ministers, Council on Water; AMCOW, 2012).

The Sahel is the poorest region in the country: nearly 80% of the population is classified as poor, in other words double the national average (INSD, 2009). The region has only one urban commune (or district), which contains the regional capital, Dori (17,000 inhabitants), and the regional rate of access to water is the lowest in the country (42.5%). Most villagers do not have access to a hand pump and collect water from non-improved sources, mainly unprotected traditional wells, water holes or dams.

In towns such as Gasséliki (4,200 inhabitants), Mansila (7,400 inhabitants), Seytenga (4,900 inhabitants) and Titabé (2,600 inhabitants), piped water systems have been in service since 2009[1]. They are managed by FasoHydro, a company that manages seven small water supply systems in the Sahel Region. In each town, the hand pumps are still managed by a WUA. The piped systems supply from three to nine tap stands, each with two to four taps. Piped water systems were introduced at a time when the existing improved sources were 35–90 metre-deep boreholes equipped with hand pumps. In two small towns (Gasséliki and Mansila), the piped systems complement the service that is provided through hand pumps whereas in the other two small towns (Seytenga and Titabé), there are, on paper, enough hand pumps to cover the entire population (Table 2).

3. Survey protocol

The study of water supply service performance in the small towns of Gasséliki, Mansila, Seytenga and Titabé is part of the action research project called Triple-S (Sustainable Services at Scale) for which the pilot area in Burkina Faso is located in eight communes of the Sahel with a total population of 300,000, in other words a third of the region's population. The main question driving this project concerns the scale at which water service management and regulation enable sustainable and universal

[1] Population estimated in 2011, on the basis of the 2006 INSD census and an annual demographic growth rate of 3% (regional average).

Table 2. Population, types of access to water and targeted population by type of service in the four small towns.

	Gasséliki		Mansila		Seytenga		Titabé	
Population 2011	4,240		7,404		4,876		2,581	
Type of access	Tap stand	Hand pump	Tap stand	Hand pump	Tap stand	Hand pump	Tap stand	Hand pump
Number of tap stand/hand pump	4	8	9	16	5	22	3	9
Coverage (max population)	2,000	2,400	4,500	4,800	2,500	6,600	1,500	2,700
Functionality rate	100%	62.50%	78%	87.50%	68%	83.00%	100%	85.00%

access to safe water in rural areas (for more information on the Triple-S initiative 'Water Services that Last', go to: http://www.waterservicesthatlast.org/).

To establish a water supply services baseline, our methodology consisted of the following:

- Calculating the life-cycle cost of each type of service (hand pumps or tap stands) on the basis of past expenditure to construct, maintain and rehabilitate the 842 hand pumps and six small piped water supply systems in the eight communes, and to organise and manage 200 hand-pump service areas and six stand pipe/on-premises service areas. In 24 villages (three per commune), the levels of service delivered to the users were determined following a two-stage survey of the entire population (55,000 people).
- Determining the quality of the water services in 20 villages and four small towns, the former solely supplied by hand pumps and the latter supplied by a mixture of hand pumps and tap stands.
- Measuring the compliance of local institutions with national regulations and the degree to which the various organisational and management roles are fulfilled by the WUA, the private operator, the local authorities, repairmen and water point caretakers.

The results presented in this article concern the performance of the water services in the four small towns where water services consist of a mixture of hand pumps and tap stands and where both cost data and service level data have been collected (to see the results on the cost of water services in the eight communes, go to: http://www.waterservicesthatlast.org/countries/initiative_du_burkina_faso).

The life-cycle costs of both types of service are made up of capital expenditure and recurrent expenditure. The latter consists of expenditure incurred to ensure the equipment works properly (maintenance, repair and rehabilitation) and expenditure to support the local authorities and service managers (WUA and private operator) in fulfilling their roles (organisation and management of water services). Table 3 defines the life-cycle cost components of a water service.

The originality of the life-cycle cost methodology lies in taking the support expenditure into account and calculating the unit cost based on the real number of users rather than the number of people hypothetically targeted by the infrastructure[2]. In this way, the demand expressed at each water point

[2] Unit costs could alternatively be calculated per m^3. Here, we consider unit costs per capita as capita is the unit being used for planning purposes in Burkina Faso.

Table 3. Life-cycle cost components.

Cost components	Definitions
CapEx	Capital invested in constructing or purchasing fixed assets such as concrete structures, pumps and pipes, boreholes, reservoirs, etc. It includes the first time the system has been built and the extension of the system. It also includes one-off software such as community training and consultation, design, procurement, etc.
OpEx	Operating and minor maintenance expenditure typically comprises regular expenditure such as labour, fuel, chemicals, spare parts, and purchases of any bulk water.
CapManEx	Capital maintenance expenditure consists of asset renewal and replacement. This occasional and 'lumpy' expenditure seeks to restore the functionality of a system, such as replacing pump rods in hand pumps, or a diesel generator in motorised systems.
Cost of capital	Cost of interest payment on any loans to finance capital investment.
ExDS	Direct support is structured support to decentralised service authorities, service providers and users related to the organisation and management of a water service. It covers technical advice and administrative, organisational or legal support, and monitoring. Direct support is often synonymous with 'post-construction support'.
ExIDS	Indirect support expenditure covers macro-level support, as well as sector planning, policy making and regulatory framework, both in terms of development and enforcement.

and its actual availability is taken into account. By cross-referencing each payment with its source, the amount each contributor (donors, government and users) has to pay for effective access to water services can be better evaluated (Pezon, 2012).

To determine the quality of the service actually delivered by each type of service, we carried out two surveys. For 4 days, an initial 'water point survey' was run at all the tap stands and water pumps. The users at each water point were identified and the amount of water taken by each was recorded. All the water points were geographically referenced. Secondly, a 'user survey' was carried out in each of the small towns in the form of interviews with all the users who had been identified during the water point survey. The aim was to understand the household structure (how many people consume the water taken by the user at the water point), what the water collected was used for (domestic use or production) and any use of non-improved sources to meet household demand. All the users' homes were geographically referenced. These surveys were carried out twice; once during the dry season (8 months) and once during the rainy season (4 months).

The data collected enabled the number of users at the tap stands and hand pumps to be quantified for each season and showed who used them throughout the year (during both seasons). The data also enabled comparisons to be made between service expectations and the actual service delivered in terms of numbers of users and water volume, and the amount of water used by each user per day was quantified. Therefore, we can determine the level of service delivered in terms of quantity for each infrastructure.

The distance to the water point was calculated on the basis of the geographical coordinates of the primary water points where the users were identified and the geographical coordinates of their homes. The distance is therefore as the crow flies.

Finally, the density of users at the water points was calculated on the basis of the number of users counted at each water point during the water point survey and the size of each user's household, as identified during the user surveys.

As regards the quality, we were not able to test compliance with World Health Organization (WHO) standards *in situ*. For the water provided at tap stands, we used the results available from tests carried out by the operator FasoHydro once a year. There is no test being done on the water provided by hand pumps.

The indicators, Water Quantity, Water Quality, Distance to Water Point and Crowding at the water point are the four parameters used within Burkinabe regulations to qualify access to water. Therefore, we used these indicators and the levels validated by the national sector policy to determine the quality of service in the four small towns[3].

4. Piped water systems deliver a better level of service than hand pumps

A better level of service is expected from piped water systems. Is this indeed the case? Analysis of the service levels in the small towns of Gasséliki, Mansila, Seytenga and Titabé shows that the piped systems do indeed deliver a better level of service than the hand pumps.

4.1. Piped water supply systems perform better than hand pumps according to all indicators

All the piped systems deliver a better level of service than hand pumps in terms of water quality. In theory, the quality should be compliant with WHO standards at all improved sources, that is to say both hand pumps and tap stands. At the hand pumps, compliance is checked when the borehole is drilled and again 15 years later when it is rehabilitated. None of the 55 hand pumps in the four small towns – or any of the remaining 449 hand pumps in these communes – has had the water quality tested since it was installed. Nothing guarantees the user that the hand pumps are providing better quality water than the traditional wells that are still widely used in the small towns and villages. As regards the piped water supply systems, the operator is contractually required to test the water quality each year. While this is not frequent enough should something happen to pollute the water, and is less often than the testing carried out in urban and peri-urban areas on the systems managed by the public operator (ONEA), it is without question an improvement on the service offered by hand pumps. The quality testing carried out on the four pipe water systems by the operator since 2009 show that the water is compliant with WHO standards. The tap stands do provide users with safe water.

The piped systems also offer a better service in terms of distance. In the four small towns, users cover less than 500 m to reach the stand pipe at any time of year, while 15–35% of hand pump users cover a greater distance in any season and of these 5–20% cover more than a kilometre (Figure 1).

The greater accessibility of tap stands is also measured in terms of density, and thus the waiting time at the water points. The number of people served per tap stand is well below that at the hand pumps in all seasons. The tap stands serve 120–170 people per tap throughout the year, while in Gasséliki, Mansila and Seytenga 30–60% of the hand pumps serve more than 400 users a day in the dry season. Note that the number of people served by hand pumps in the dry season is 20–50% higher than that observed during the rainy season, which increases the density of users and waiting time at hand pumps. Therefore, the level of service provided to hand pumps users decreases during this season.

[3] For a detailed presentation of the methodology and the service scale tool, see Pezon (2012) and Pezon & Bassono (2013).

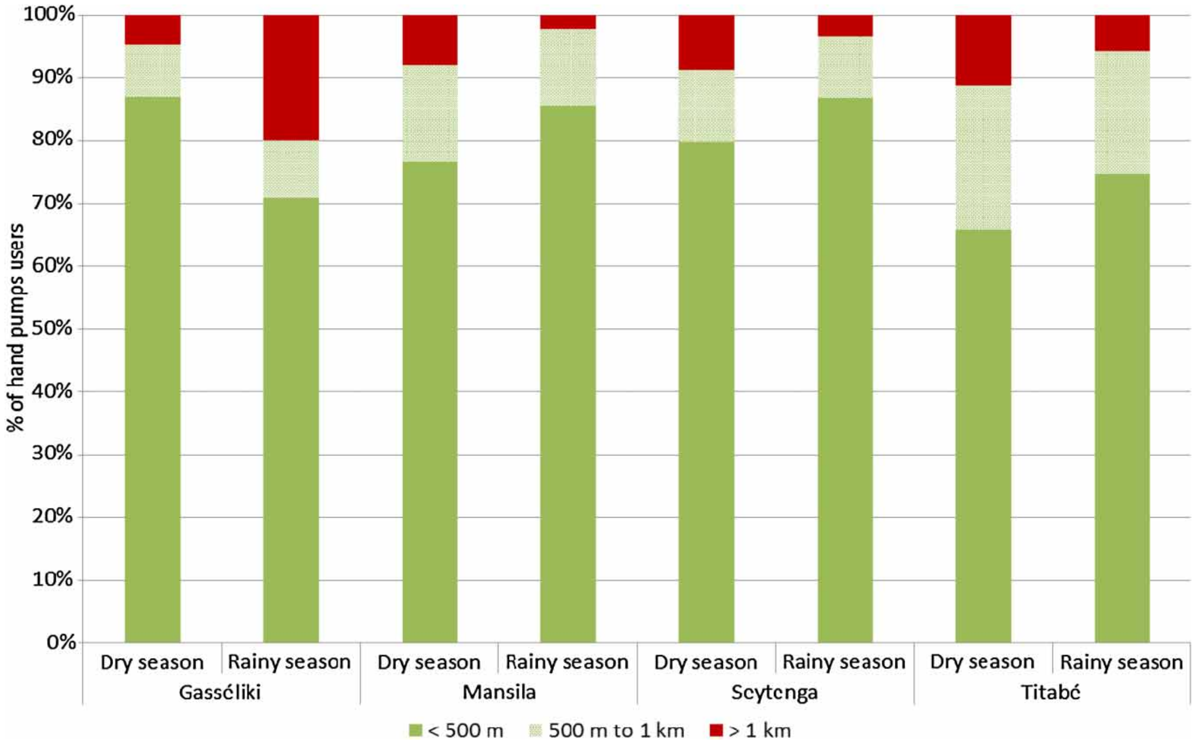

Fig. 1. Distance to hand pumps by site and by season.

The quantity of water fetched from the tap stands is on average comparable to that taken from the hand pumps. However, on closer inspection, a higher number of tap stands users fetch more than 10 l per person per day (more than 60% in Seytenga in the dry season and in Mansila and Titabé in the rainy season). Twice as many consume more than 20 l/c/d – the official standard in Burkina Faso. In Seytenga, 40% of the tap stands users exceed this threshold during the dry season (Figure 2).

4.2. Piped water supply responding to demand

Piped water systems deliver a better level of service than hand pumps to a number of users commensurate with the target population. The demand for this level of service exists, including in the very poor region of the Sahel. Three of the four small piped water systems supply the target population throughout the year (Figure 3). In Gasséliki and Titabé, there are almost as many users at the tap stands as at the hand pumps. While the hand pumps in Gasséliki are over-stretched (the number of users exceeds the capacity of functioning hand pumps), this is not the case in Titabé where the hand pumps have the capacity to supply 300 additional users. In Seytenga, the piped system is operating fully and supplies as many users as the hand pumps, which have the capacity to supply double the numbers.

The number of regular users at the tap stands is comparable to or higher than those using the hand pumps (Figure 4). The regular users are those who take water from improved sources throughout the

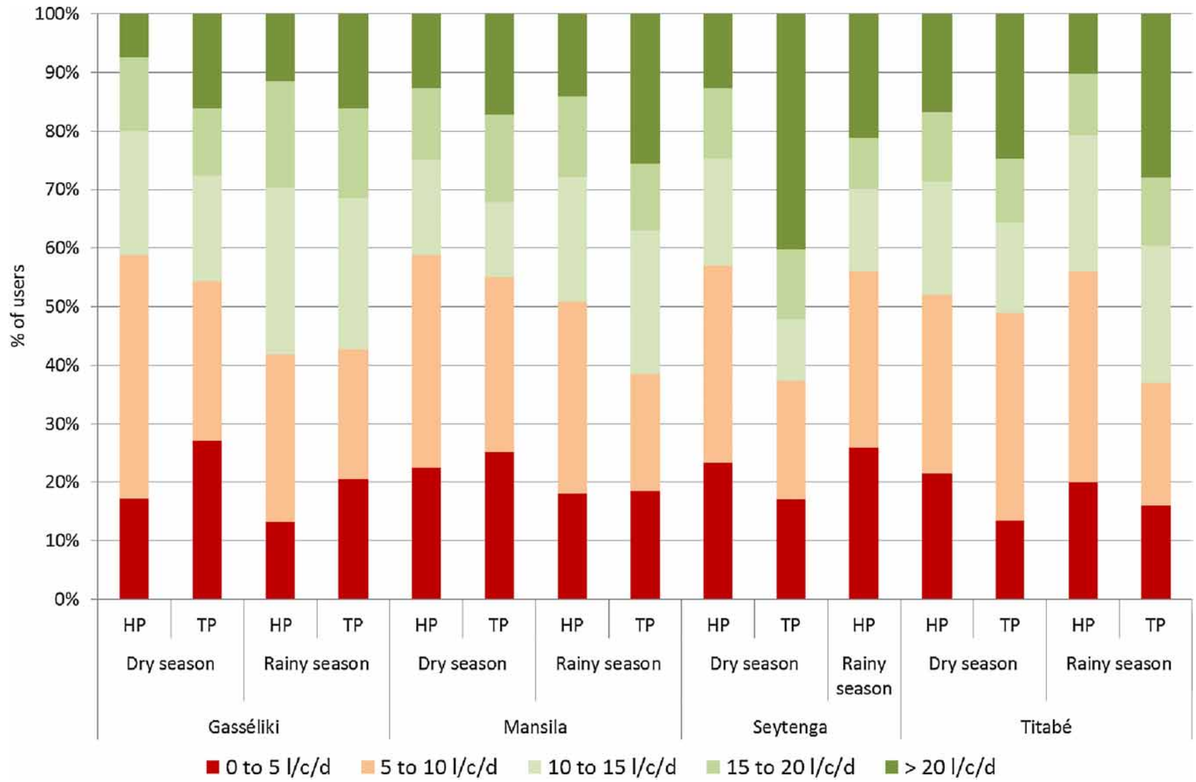

Fig. 2. Quantity of water collected at hand pumps and tap pipe per season in the four small towns (litres per capita per day, l/c/d).

year, whether during the dry or rainy season. However, after 3 years of operation, the tap stands users are more regular than those at the hand pumps, three quarters of whom only come during the dry season when alternative sources have dried up.

In light of the poverty levels in the Sahel, the existence of such a demand could be seen as surprising. For an average consumption level of between 10 and 20 l per person per day, the water from the piped systems is on average 10 times more expensive than that from the hand pumps[4]. However, the quantities consumed by the users are comparable on average, whether the water is from tap stands or hand pumps.

These quantities remain insufficient but it appears that they can only be increased by providing service delivery through on-the-premises connections. By eliminating the distance to be covered to reach the water points, it would probably become possible for a certain number of users to completely forego non-improved sources. The latter remain, in the four towns, the users' main source of water.

Finally, very few users exclusively fetch water from improved sources to meet all their domestic needs throughout the year. Fewer than 800 users go solely to tap stands, the only improved source that supplies water of confirmed quality.

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[4] For a consumption of 15 l per day, a user would pay about 2,700 FCFA per year at a tap stand (500 FCFA per m^3) whereas the annual contribution to access a hand pump is 250 FCFA per capita.

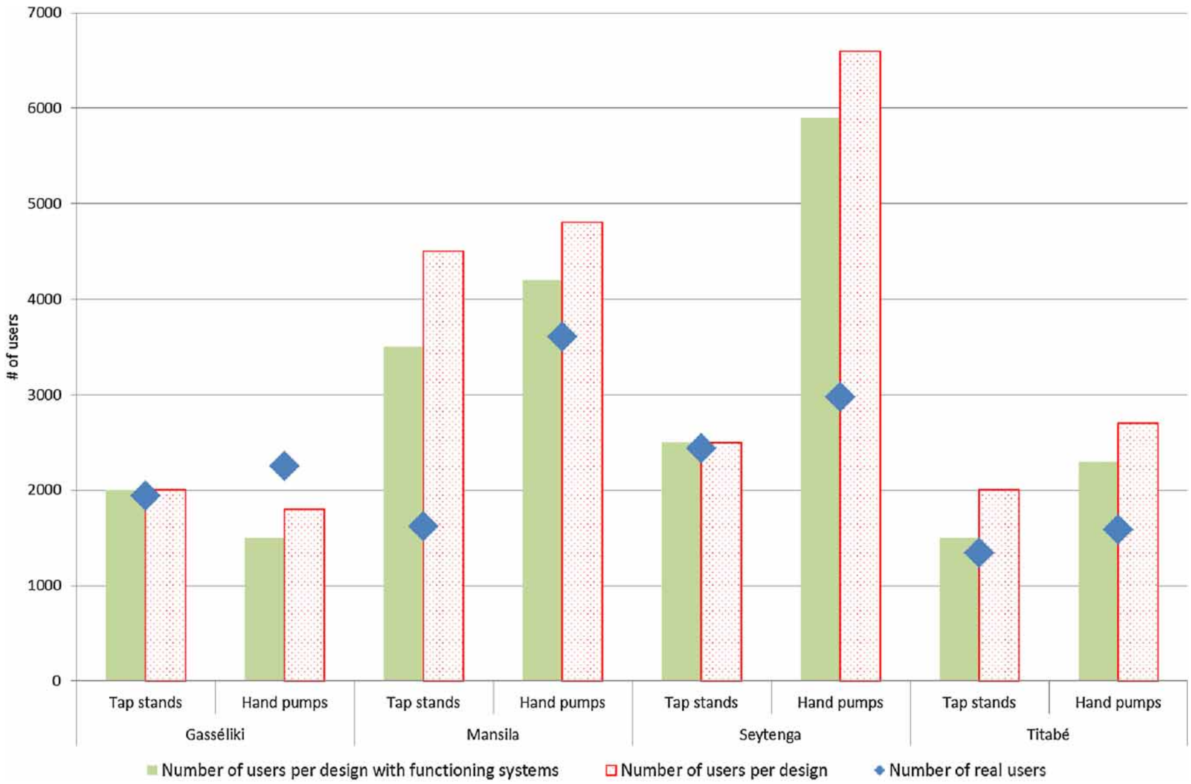

Fig. 3. Number of users served per type of improved water source, per design and in reality.

4.3. Supplying water through tap stands is less expensive than via hand pumps

If the service is to be extended to a maximum number of people, it is important to know the respective cost of the infrastructure. What should be done in the four small towns – should the piped system be extended or should the number of hand pumps be increased and the water quality tested regularly? Are piped systems with a capacity of between 1,500 and 4,500 people or between 10,000 and 33,000 m^3 really cheaper than an equivalent supply by hand pumps? Again the questions must be answered empirically. How much does it cost to supply water via tap stands in comparison to hand pumps on the basis of the actual number of users and not on the basis of the number of people theoretically targeted by each installation?

To compare the cost of piped water supply to that via hand pumps, we collected data on the expenses incurred for each type of system from the outset and then calculated the life-cycle unit cost on the basis of the number of users actually supplied[5].

4.3.1. Comparable capital investment. In terms of capital expenditure, supplying water through a piped scheme is not more expensive than installing hand pumps (Figure 5). A piped scheme costs

[5] For a detailed analysis of life-cycle costs of hand pumps and piped water systems, see Pezon (2013).

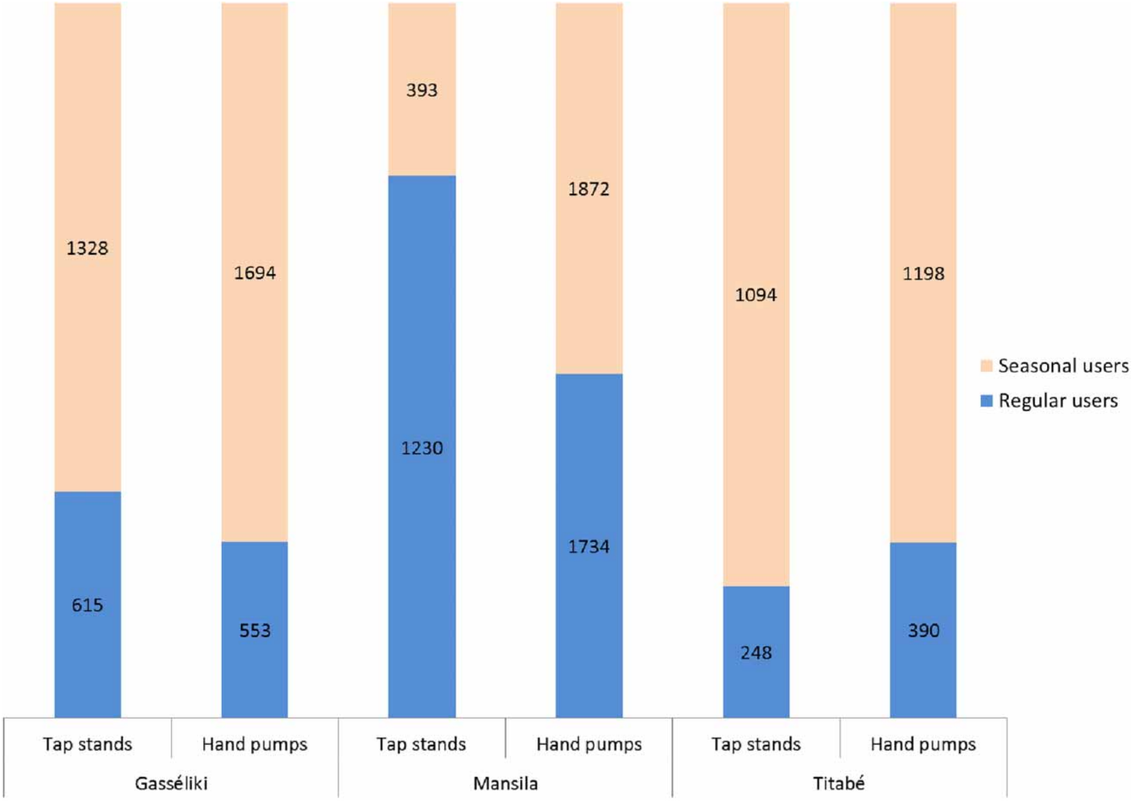

Fig. 4. Regular and seasonal users of improved sources per site.

between $84 and $131 per end user and hand pumps between $63 and $154 per user. In Seytenga and Titabé, the unit investment costs for a piped system are lower than those for hand pumps.

The gap between users and theoretical users significantly alters the hierarchy of unit investment costs. Indeed, on the basis of theoretical users or users per design, the hand pumps are $20–40 cheaper per user than piped water systems, except in Mansila where the piped scheme is large enough (nine tap stands) to achieve economies of scale which lower the investment cost per theoretical user to $30 less than that of a theoretical hand pump user. However, on the basis of the number of actual users, the situation is very different. In Gasséliki and Mansila, tap stands cost $20–30 more per user than hand pumps and $10–40 less in Seytenga and Titabé.

This inversion is due to demand and, more precisely, to the fact that the demand for service per tap stand is commensurate with the installed capacity. The relatively high nature of the unit investment costs for hand pumps is also due to the breakdown rate. At the four sites, 55 hand pumps are installed, of which 10 were not working during at least one of the two seasons. The investment made to build these hand pumps cannot achieve its objective in terms of number of people supplied, which increases the unit investment cost for this type of access. When fully functional and supplying 300 users per hand pump, a service via hand pumps would cost $40–50 less per user than supply via tap stands. However, full functionality is unheard of and the average rate of hand pump non-functionality in Africa (30–35%) is close to double that observed in the Sahel (18%). In contrast, almost all taps were fully functional.

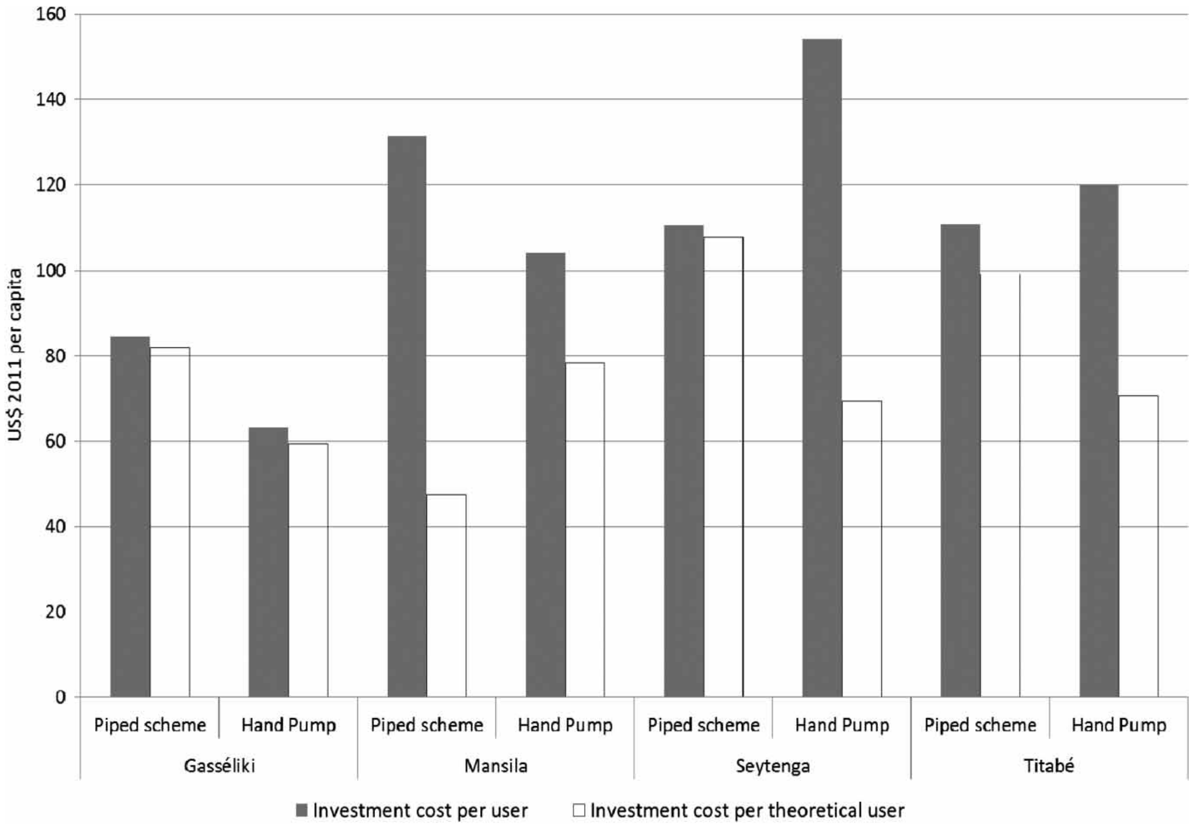

Fig. 5. Investment cost per user and per theoretical user of hand pumps and small piped scheme.

4.3.2. Higher operating and capital maintenance costs for piped systems but these decrease as the number of users increases. In terms of operation and capital maintenance, supply through piped systems is more costly than via hand pumps (Figure 6).

The operation of hand pumps costs from $0.40–1.10 per user per year as against $1.70–3.60 for piped systems[6]. The capital maintenance expenditure for hand pumps varies from 0 to $1.80 per user and per year as against $0.10 or $0.20 for piped systems which, we must recall, date back only to 2009. A provision of between $1 and $1.60 per person is set aside to fund future capital maintenance of the piped systems.

At this stage, it is important to recall that the costs are calculated on the basis of past financial expenditure: these are not the ideal costs but observed costs. For a hand pump to be replaced after 30 years – the estimated lifespan of a hand pump in Burkina Faso – the equivalent of $2.60 should be set aside per person per year (excluding inflation). However, no provision is made by either hand pump managers or the local authorities to renew this infrastructure.

For the two sites where data on hand pump capital maintenance expenditure was available (Gasséliki and Mansila), the gap between the unit costs of the two types of equipment (excluding the provision) is

[6] The same magnitude is observed when unit costs are calculated per m^3.

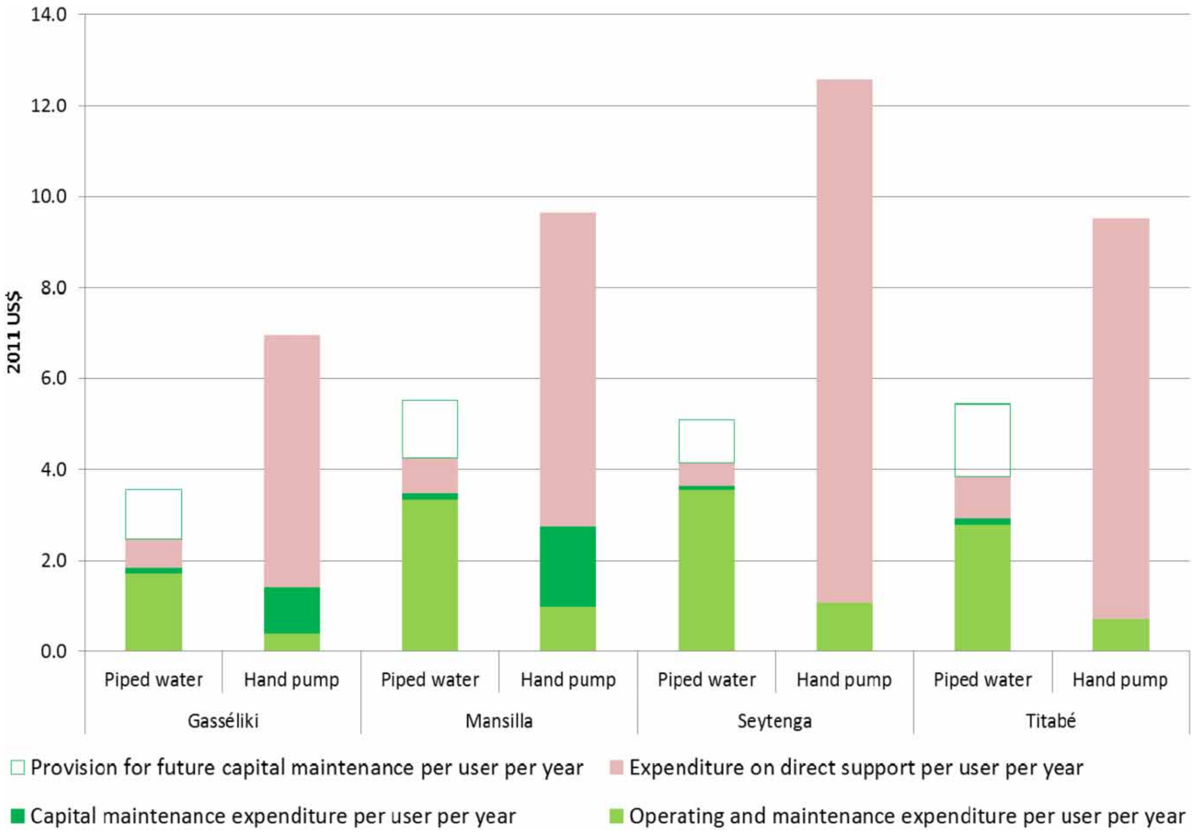

Fig. 6. Recurrent cost per capita per year for providing water through hand pump or small piped scheme.

very small: the piped water systems of Gasséliki and Mansila cost respectively $0.40 and $0.70 more per user per year than hand pumps.

However, the unit cost of operating the piped systems decreases as the amount of water distributed increases. It drops from $0.66/m^3 per year for 5,000 m^3 distributed to $0.43/m^3 for 12,000 m^3 distributed. In contrast, the unit cost of operating a hand pump increases as the volume distributed increases: it rises from $0.11/m^3 for a hand pump supplying 7,800 m^3 per year to $0.25/m^3 for a hand pump supplying an annual volume of 14,500 m^3. Its capital maintenance unit cost increases by 50% under the same circumstances. In Mansila, where there is the largest piped system (4,500 theoretical users), each m^3 distributed by the system costs $0.44 per year in operating and capital maintenance costs, as against $0.68 per year for hand pumps.

4.3.3. Support costs that blow the life-cycle costs of hand-pump service delivery out of the water. Services provided by hand pumps are considerably more expensive in terms of support than piped systems. Less than $1 per user per year for a piped system, support expenditure varies between $4.5 and $9.5 per hand pump user per year.

The support received by hand pump managers (WUA) and local authorities to organise water services using hand pumps is much greater than the support that the piped water system manager and the local

Table 4. Life-cycle cost of water supplied by piped scheme or hand pump (US$ 2011).

	Gasséliki		Mansila		Seytenga		Titabé	
	Piped scheme	Hand pump	Piped scheme	Hand pump	Piped scheme	Hand pump	Piped scheme	Hand pump
Investment cost/user	84	63	131	104	111	154	111	120
Recurrent cost/user/year	4	6	6	8	5	11	5	8

authorities receive specifically to organise their piped services. Finally, a piped water system costs less per year per user, including provision for capital maintenance, than the per-user cost of hand pump support alone, excluding pump operation and rehabilitation costs.

Overall, in terms of capital investment the cost of piped water supply is comparable to the supply via hand pumps, even in the case of the small system in Titabé whose capacity is limited to 1,500 people. In terms of recurrent expenditure, water supply via a piped system is clearly cheaper per actual user than supply by hand pump (Table 4).

This observation confirms the economic theory that over a certain size it is cheaper to distribute water via a piped system than in a decentralised manner. Networks (whether for water supply, electricity, communication, or transport, etc.) benefit from increasing returns: within the limits of the installed capacity, each additional m^3 produced or each additional user supplied costs less than the previous one. Therefore, it is economically justified to adopt a piped system rather than decentralised distribution (via hand pumps) once the average or unit cost of piped distribution is less than the average or unit cost of decentralised distribution. This is the case on all four sites studied.

5. Discussion and conclusion

5.1. Piped water supply services perform better

It is less costly to supply users via tap stands than by hand pumps, *while at the same time they deliver a better level of service*. This is the case in Gasséliki, Mansila, Seytenga and even in Titabé, where the piped system's capacity is only 1,500 people or 10,000 m^3.

This type of service is affordable for a large enough demand and the extension of these piped systems should be encouraged rather than rehabilitating hand pumps or working to support WUA. Not only is the overall performance of the 200 WAUs in the eight communes after 6 years of continuous support fairly unsatisfactory, none of those in the four small towns is operational at all. In Gasséliki, Mansila, Seytenga and Titabé an increase in demand (number of users or volume) at the tap stands would lower the unit cost of piped water supply without harming the quality of the service delivered to the end user. An increase in demand at hand pumps would lower the level of service (already very mediocre in the dry season) and would increase its unit cost.

This study shows that the threshold of 3,500 inhabitants that currently determines which type of equipment will be funded by the Ministry of Water, should be reconsidered. Up to 3,500 inhabitants, a 'village' cannot hope for better than hand pumps within the national framework. However, our data indicate that it is economically more advantageous to construct small solar-powered piped water systems starting from 1,800 inhabitants (Figure 7).

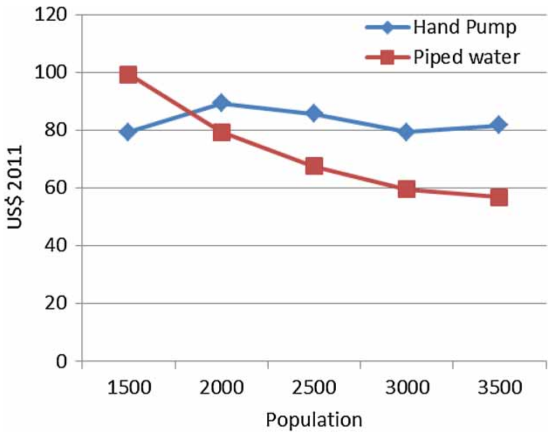

Fig. 7. Investment cost per capita to supply water through hand pumps or piped scheme from 1,500 to 3,500 inhabitants.

5.2. Price distortions

Local inhabitants are not encouraged to fetch their water at the tap stands, rather the opposite. The prices recommended by the Ministry of Water clearly position the piped water systems as a luxury service whereas the water at the hand pumps must be financially accessible to all. The regulations stipulate that each household must pay a minimal charge of 2,500 FCFA per year ($5 per year for an average family of 10 people) to have access to the hand pumps and take the equivalent of 20 l per person per day. At the tap stands users pay according to volume the equivalent of 500 FCFA ($1) per m^3.

This explains why the service at the tap stand is more costly for users than that at the hand pumps. The user of a hand pump does not see that support worth from 10 to 20 times his annual contribution is provided to offer him this service.

The price does not play the same role in financing the two types of service. The price of water at the hand pump must be able to cover the upkeep costs (care and maintenance) of this infrastructure. The price of water at tap stands must be able to cover the upkeep costs, operating costs, part of the capital maintenance costs, the support and the profits of the operator.

5.3. Development assistance: assisting who and why?

The fact that every year, expenditure on supporting the organisation and management of hand pump services costs double the actual management of a piped water service is perplexing to say the least. Indeed, there is no logical justification for subsidising a lower quality and more costly service to such an extent. The inclusion of support expenditure in calculating the cost of access to water and being able to document it would help to better understand this phenomenon.

More radical critics of development aid range from those who, like J. Sachs (Sachs, 2005) call for a massive increase in development aid, to those who, like Easterly and Moyo call (Easterly, 2001; Moyo, 2009), on the contrary, for this regime to cease because it is counterproductive to its main objective: the development of countries and populations. Increased aid for hand pump water services would mean water quality could be tested and broken-down hand pumps rehabilitated. Stopping aid could plausibly lead to more frequent interruptions of the hand pump service and to a higher rate of breakdowns. In the Sahel Region, hand pumps could no longer fulfil their current role of replacing the non-improved sources that dry up at the height of the dry season.

Our objective here is not to decide one way or the other, but rather to reiterate that development assistance is meant to enable development and not to perpetuate development assistance and support the associated stakeholders. The financing allocated to hand pump services is not part of a development strategy but one of assistance. It is responding to an immediate situation. But hand pumps are no more accessible than non-improved sources and their water costs. More worrying still, the water may be polluted. It is not rare to find boreholes in Burkina Faso that the villagers call arsenic boreholes. What type of impact in terms of public health can we expect from a so-called improved source where the water quality is not regularly tested and that is a 2 km walk away? What type of impact in terms of income or well-being can we expect from water carried up to 1 km and which requires such investment in time and effort?

We expect better access to water to spur development arising from improved health and more spare time available to take up other activities, whether income generating or not. At best hand pumps enable people to stay in their villages and survive. The aim of development assistance is thus to uphold the right to water providing the water quality is regularly tested. Is it possible to control the quality of the water distributed by 40,000 hand pumps when we know that in France the regular control of 8,000 water catchments is problematic? Should household water treatment at the point of consumption be promoted and supported too?

Piped water distribution promotes development on several levels. Firstly because the water supplied is drinkable and a piped system can be extended and the scale of the service can be gradually expanded, with an increasing impact on development. We know that drinking water may be safe when it is drawn but may not be by the time it is consumed. Studies have even shown that a household connection alone may have a significant impact on health (Howard & Bartram, 2003; Günther & Günther, 2010). Piped water distribution brings the point of supply closer to the point of consumption. Doing this reduces the risk of contamination as well as reducing the time spent on water chores. Furthermore, its average cost diminishes with the increase in quantity of water distributed. Over a certain number of users, the marginal cost of supply is so low that the poorest could be supplied under acceptable economic conditions.

The problem is not so much the abrupt increase or interruption of development assistance than its effectiveness. What are the obstacles to redeploying aid to types of access that bring development and therefore will be sustainable in the long-term?

The key is not to subsidise water but its access. Sound studies have shown that, as much in the field of water as in that of energy, equity requires not that water (or electricity) be subsidised, which only favours those already supplied, but its access (Komives *et al*., 2005). It is therefore not a matter of subsidising operation (to lower the price) but of extending the service by building new tap stands and connecting village households.

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