

# **The implementation of water-metering in Belgaum (India), a management situation reconfiguring water consumption practices**

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## **ABSTRACT**

The article concerns the diffusion of water-metering by a private French company to public authorities in an Indian city. It studies the meaning attributed by the end user to the installation of this tool, and the progressive implementation by the company of a management model behind it, i.e. the payment of water based on consumption. The case study chosen illustrates how the water-meter that embodies a new information and management strategy is inserted into local practices. The article mobilizes the management situation's concept through the way in which the participants act and by embracing the dynamics of the situation: it aims at describing how the tool has been adapted by the users to fit to the local norms over the payment of water supplied by the public water supply system; it also points at analysing how the trust in this system and the perception of the water-meter in turn shape the end users' water consumption and storage practices.

Key words: Management situation, diffusion, appropriation, trust, water-meter, India.

## **1. Introduction**

Water-metering is a technology dating back to the mid-19<sup>th</sup> century. It plays a key role in the management of urban water supply networks, by having a technical, informational and financial function, notably having an element contributing to the setting of user charges (volumetric pricing). It has been highlighted as a tool for demand control and for resource conservation. This model is largely the norm in the “North” and is promoted as the basis of a financially sustainable water service.

The diffusion of water-metering in the sociotechnical context of an Indian city by a French water company, Veolia Water, constitutes the background of this article based on a case study. The project sought to improve the urban water supply services in Karnataka, with the support of the World Bank and the State Government. It involved a major change in a pilot-area of Belgaum: a shift from a discontinuous to a continuous water supply service (“24 hours/7 days”), along with a passage from a flat rate system to a tariff system based on the payment of the water as per the consumption.

This shift from a payment model to another one puts in evidence the notion of trust by the users in the permanence of an improved water supply system and in the capacity of the utility to maintain a quality of service. The level of trust of the users in the system influences the way they would incorporate their old consumption practices into the revamped service.

Through this case, we are in presence of a management situation involving the two extremities of the service, i.e. the utility and the users, or the managerial and the households' levels.

The article harnesses this concept of management situations (Girin 2011) to explain the transformations produced by the introduction of water-meters. It aims at studying a partial social phenomenon: the impact of the introduction of that information tool on the water consumption and storage practices from alternative sources. The research methodology relates to the interaction between the specific object of study, the water-meter, and its context (Chiapello and Gilbert 2009) and to “locally” observe phenomena (Olivier de Sardan 1995). The results stem from a qualitative households’ field survey conducted in the city of Belgaum in 2011-12, four years after the implementation of the new service.

The new service implemented by Veolia ensured a regular and pressured supply of potable water to the households connected to the public water supply network. Prior to this, the water supply from the public water supply system was intermittent, low-pressured and unreliable. Consumers were provided with an irregular supply of water once in every three days for a few hours. Consequently, they had to devise alternative means of water supply and storage in order to cope with the irregular service. These problems of erratic supply and pressure were eliminated by the new system. Post implementation, consumers were charged for the water service based on the amount of their consumption, rather than a uniform flat rate.

We mobilize the management situation’s concept through the way in which the participants act and by embracing the dynamics of the situation (Girin 2011: 200): we question if the new and improved management system of 24x7 and pressured water supply makes the existing alternative means of collecting and storing water devised by the people redundant. Behind this question lies the assumption that technical objects are boundary-objects fulfilling two purposes: they don’t only set limits but also help to initiate coordination between systems (Akrich 1989: 38; Akrich 1992, 2006). The same question leads to survey if there is an incorporation of the new system into the existing consumption practices, or a complete elimination of the old system? We assume that innovation is involved in the process of how users recompose their existing consumption practices with the new system. In that perspective, we analyse the innovation process based on the representations of the users (ibid: 38). Further, we discuss the impact of the new system of volumetric payment on the water consumption practices of the users.

Theoretical background refers to streams of literature involving issues related to the translation of management models and tools in the development intervention world (Bocquet et al. 2008; Giraud et al. 2003; Graham and Marvin 2002; Renaud-Hellier 2007; Rottenburg 2009). We also mobilize the literature on water supply situation in developing and Indian cities (Bakker 2005; Barraqué 2001, 2013; Cassell and Mehdi 2007; Coelho 2005; Massardier et al. 2014; Mc Kenzie and Ray 2008; Zérah 2003).

These streams of literature aiming at different scales of analysis help to better harness the concept of management situation (Girin 2011) covered by our case on the reconfiguration of water consumptions practices following the diffusion of water-metering. The intermediate positioning that the management situation’s notion holds, between the macroscopic and the microscopic levels, enables us to adopt an holistic research perspective embracing both the global level – “society at large or the large corporations” – and the local one – “single individuals and their interactions” (ibid: 200).

Hence, the contribution of the article through the empirical case study lies in connecting issues at different levels of analysis encapsulated in one question: How a management situation characterized by the diffusion of a water management model from the North (macro), in the socio-political water supply context of an Indian city (meso), produces a particular form of reappropriation of water-metering by the end-users (micro).

The case study proposed contributes to enrich a perspective looking at the individuals' level which remains marginalized in a literature of transposition and diffusion practices predominantly driven by a research oriented towards the macro level and lacking this micro level focus (Boxenbaum & Battilana 2005: 356). Quiet often, the models are thought to be diffused and imposed from the top without taking into consideration their appropriation by local groups (Massardier et al. 2014: 69-70).

The article adopts an analytical perspective developed in three levels and sections, evolving from a global perspective to a local one:

- **Section 2** explains the emergence of the diffusion of a water supply management model from the North and its confrontation with the sociotechnical contexts of the South.
- **Section 3** explains how the bottlenecks of the Indian water supply situation offer some space for this metering model to develop despite strong social and political oppositions.
- **Section 4** shows, through the management situation illustrated by the Belgaum case, and the households' survey, how this model is altered by the local reality of water consumption practices.

The approach of studying that management situation “through the way in which the participants act” (Girin 2011: 200) answers our concern of understanding a partial social phenomenon. This focus on users' actions also requires considering wider perspectives to understand the rationale behind the implementation of water-metering.

The article's final contribution lies in proposing descriptive typologies (Dumez 2016) dealing with the management situation end-users are facing: how the introduction of the water-meters has redefined the pre-existing consumption patterns and sociotechnical systems of consumption.

The case finally helps to identify causal patterns in the impacts of the diffusion of a management model and its translation in a particular water supply context. These descriptive typologies help to identify how a change produced in a particular management situation, here the introduction of a technical device, participates to the construction of the notion of 'environment' in end-users' mind.

## **2. Macro-perspective: The diffusion of a water management model from the North confronted to fragmented networks in the South**

### **2.1 The diffusion of models and tools and the need of trust for their acceptance**

The world of development cooperation is probably one of the sectors most exposed to practices of diffusion of management models and tools across the globe. In that specific sector, the trend of diffusion consists in “selecting one of the existing globally circulating and highly esteemed models for development and adapting in to a local context” (Rottenburg 2009, xxvi). In his essay, “Far-Fetched-Facts”, Rottenburg mentions that these models are attached to specific technologies that contain an “agency of their own”.

Being disseminated and duplicated in different sociotechnical contexts of reception, these models and tools acquire in the course of their diffusion a plasticity that help them fit to the existing local consumption's norms and practices. In that dynamic process, these technologies are often given a different meaning. Sometime users confine these tools to a restricted space and have them fulfil purposes that are very different from the ones they were initially designed for. Beyond the users, these models and tools promoted and brought in developing countries by external agencies (e.g. donor agencies, multilateral organizations) have to confront the logics

of action, the rules and norms of the local executing organizations; and again, these logics don't necessary help these models and tools to fulfil their initial purpose. For instance, in certain societies of Africa, in transactions taking place in the framework of markets and bureaucracies, Rottenburg underlines that the interpersonal trust often takes precedence over the trust in the system and impersonal rules, (ibid: 62). It is thus crucial that the intervention by the actor takes into account the "context of interaction", which is not just the knowledge of technology, but also "local norms-ethical norms and standards of truth" (Girin, 2011).

## **2.2 Companies backing the "Modern Infrastructure Ideal": a model with limits**

The project we study inserts itself in this movement of diffusion across the globe of the "modern infrastructure ideal" (Graham and Marvin 2002: 40). This refers to the emergence of an ideal across the metropolis of the industrialized countries, where "small, fragmented islands of infrastructure were joined up, integrated and consolidated towards standardized, regulated networks designed to deliver predictable, dependable services" (Graham and Marvin 2002: 40 in Bocquet et al. 2008: 1). This evolution that took over a century (1850-1960) is sought to be radically changed, for developing cities, in the case of water supply networks, into delimited timeframes, due to an exponential demand. These tentative have to confront "splintering", characterized by sustained fragmentation of the provision system and access. In most developing countries, the "modern infrastructural ideal" is largely beyond the horizon, in a general context of poor management, increasing population pressure and resource depletion.

This splintering phenomenon can be applied to our case: "In many developing cities, the ideal of distributing drinkable water and sewerage services to all has long been abandoned. Instead, highly dualistic systems are often in place (Graham and Marvin 2001: 3)." The persistence of wells in Belgaum highlighted later in our survey's results comforts the authors' analysis. But they also point out the existence of reforms: "A set of processes is underway (...) in ways that help sustain the fragmentation of the social and material fabric of cities" (Ibid: 52.) For many such cities, this "splintering" may have its roots in the colonial era (Bakker 2005). This quest for efficient pathways to the infrastructure ideal for water in developing cities has stimulated comprehensive reform processes in the public authorities predominantly responsible for the provision of the water service. Such processes often developed under the aegis of multilateral institutions (e.g. World Bank), at times involved the intervention of infrastructure companies of the 'North', sometimes through 'Performance contract' projects. These projects include the display of 'best practices' and technologies, as illustrated by the intervention of Veolia in Belgaum.

## **2.3 The way ahead: Towards complementary local technical solutions?**

Beyond the attention paid to the question of public-private partnerships and audible critiques of 'privatisation' and 'commodification', lies a larger sustainability issue, the fact that global water companies propose the "water system of the second age", which largely emerged in contexts of abundant and easily obtainable water.

Where water is often rare, it is time for a third type of system: the 'ecological' system of integrated and differentiated management of the resource (Barraqué 2001: 15), given the prospect of its non-renewability in different regions (Renaud-Hellier 2007, Bakker 2005). Interestingly, this has led to the re-framing of water as a "common good" as seen with the 2006 law in France declaring a "right to water", while keeping the principle of "water pays for water", i.e. user charges. Giraud et al (2003) propose that the monolithic models of public agencies be modified to incorporate complementary local technical solutions, as "the current offer of private western companies is not adapted to numerous urban situations of developing countries" (ibid: 14-16). To our understanding, the alternative sources of water (e.g. wells) used in Belgaum fall under the scope of this ecological system.

Relatively less studied in the Indian context is the question of how the implementation of this management model (payment as per consumption) and tool (water-meter), impact the management of the resource and the service, and the users' access to the service.

### **3. Meso-perspective: Water-metering in Indian cities, a status quo between a need for tariff reform and the water commodification issue**

#### **3.1 Water-metering: a response to information gaps, cheap water and poor supply**

Poor management is a major factor explaining the deficiencies of the Indian public water supply system: "The consequence of over-staffing, under-pricing, and high levels of unaccounted for water is that most urban water utilities in India are unable to cover even operating and maintenance costs out of revenues from tariffs, let alone provide capital for the expansion and improvement of the network" (McKenzie and Ray 2008: 6). The political administration of public infrastructure takes precedence over financial viability of day-to-day operations, accompanied by an absence of managerial tools to evaluate the water production and distribution costs, and notably a deficiency of information systems to estimate the demand for water (Zérah 2003a: 94; 2003b: 401; 2006: 141).

The preservation of very low water tariffs is symbolic of this *status quo* situation linked to the electoral postures of members of local assemblies. It does not only concern the sizeable proportion of low-income populations but even the middle classes. It is in line with the expectation of the large section of the society towards a protective State. Historical anthropology indicates an Indian political culture where the sovereign or head of the State owes protection to all his subjects without distinction. The particular evolution of Indian democracy reflects the continuity of the protective role that the State has kept up in its relationship with citizens. Until recently it was designated as *ma-bap*, literally, "mother-father" (Jaffrelot 2005: 38). This expectation of the population towards a paternal State manifests itself today in the massive participation of the poorest populations in the different polls.

#### **3.2 Water-metering presented against the principle of water as nature's gift**

The low tariffs situation is also in line with the more contemporary argument that water is a human right and not an ordinary good. The position of the NGO Navdanya on water illustrates that argument: "Water is nature's gift. The right to water is a natural basic right of all (...) Water cannot be commoditized and privatized" (Navdanya 2003). In such a context, tariff reform has to face accusations of 'commodification' and 'privatization' of water (Coelho 2005: 176). Most often, decisions on water tariffs have to get the approval of the State Government and are rarely based on economic criteria alone (Cassell and Mehdi 2007: 5). With tariffs well below the cost of service delivery, cost recovery is rare, and renders equally difficult the financial equilibrium of public water services, resulting in a lack of resources to improve and extend the water supply system.

The vicious cycle of low tariffs combined with poor supply, especially in a context of increasing population pressure is leading into a spiral of environmental unsustainability: very cheap water perceived as 'free' by users contributes to excessive storage and wastage. These regressive social effects of unreliable, inadequate and low quality supply are inter-linked with the consequences of the unregulated 'alternative water economy' in terms of resource depletion and degradation (ibid 2007: 7): the fleet of private water lorries in Belgaum's streets symbolize this alternative water economy which provokes the wrath of the rural population deprived from a significant share of their water resource going to the urban areas.

However any actions involving transitions (e.g. changes in tariffs, private sector participation, creation of independent water boards accused of ‘depoliticization’ of public service) have to confront protestation, whether from elected members, NGOs, users, or public service employees. Where it concerns multinational corporations and the World Bank, a heightened resistance is generally put up by local NGOs and activists often based on a confusion between the privatization of services with that of resources, at best considering the privatization of the water services as the first step towards “privatization of water” (Shiva 2002). This confusion is observable for anti-globalization movements in Europe (Barraqué 2005: 2-3).

### **3.3 Transition to water-metering and its compatibility with a social agenda**

From a managerial perspective, water-metering with volumetric charges holds out the promise of a ‘virtuous cycle’ that can cut the Gordian knot of unsustainable pricing practices, poor management of supply and resource depletion. But environmental policies are not always beneficial to the most vulnerable populations: the integration in the water tariff of increasing costs of water treatment and preservation, and the volumetric tariffs meant to limit the consumptions can affect the poor and large families. (Massardier et al. 2014: 65).

The conditionality of Indian national policy and funding support for the achievement of continuous supply under a scheme (JNURM), has included a commitment to the “levy of reasonable user charges” (GOI 2011: 1) requiring the water-metering of all consumers: “Cost-recovering water charges combined with a well-targeted subsidy scheme for the poor will contribute to maintain and extend the network, assure better quality of water and improved services while ensuring that water remains affordable for all” (ibid.: 3). This represents a major shift, acting as an incentive to municipalities to move in the direction of universal water-metering: the technical assistance was initiated before the national policy impetus for full water-metering with volumetric billing. The diffusion of this policy is indicated by a multiplication of “24/7” with water-metering initiatives in second-tier cities (Nagpur, Mysore).

Overall, within the volumetric tariff structure, tariff levels are too low for cost recovery. And the effectiveness of large-scale water-metering is reduced by managerial and technical factors: a poor infrastructure maintenance (e.g. leakages), deficient technical parameters (e.g. low pressure), and a lack of managerial incentives enabling a follow-up of water-meters management (e.g. readings, billing).

These considerations on the water commodification invite looking at the ground level on how these transitions impacts the users. The management situation characterized by a shift to a volumetric payment of water in the water-metering project in Belgaum offers the opportunity to question how the users insert this tool in their pre-existing sociotechnical context of water and how it transforms their consumption practices.

We first aim at defining this particular management situation and then at précising how we approach it through the case of water-metering in Belgaum.

## **4. Micro-perspective: Water-meter’s appropriation process through the lenses of management situation**

### **4.1 Water-metering, a management situation with actors of divergent rationalities**

The analysis on the political economy of water in India proposed in the previous section constitutes a background to introduce the issue of the management situation of the water-metering project in Belgaum involving two actors that have divergent perspectives on it.

The parameters of the water-metering project conforms to the definition of management situation (Girin 2011: 198-200) approached from the perspectives of the main actors in presence:

From the company's side:

- The project limited timeframe imposed to the company with limited resources and within certain constraints are united to accomplish in a determined time a collective action leading to a result submitted to an external evaluation;
- The timeframe linked to the result imperative is fixed in advance with an agenda that includes intermediate steps;
- The result is a compromise and is sometimes negotiated;

From the users' side:

- The results do not only conforms to an instrumental rationality; The users did project on water-meters their own conception of their usefulness;
- Participation can be an obligation or an opportunity to realize other objectives;
- The participants are not paralysed by the project.

The company faces a management situation marked by the imperative of metering all consumers, under a limited timeframe, in pilot areas. That collective action involving the Karnataka State is performed under the evaluation of the World Bank. The objective of having households relying exclusively on the revamped public water supply system understates that they would stop using their alternative sources of water once the 24/7 supply is operational, which is not happening.

An environmental agenda with financial implications lies behind the water-metering project which implied a reform of the tariff system: an increase of revenue would allow the utility to invest in the maintenance of the infrastructure and diminish water losses. This shift to a volumetric payment system is performed through compromises and negotiations: users unable to pay their bills are offered the option of payment with instalments; those not able to pay their arrears are given a delay to settle the situation, prior to a final warning before disconnection. Hence, the company is driven by a management situation with the goal of diffusing the water-meters for a better use of water as a resource with a financial rationale.

On the other side, the users end-up finding their own space in a management situation in which they are enrolled with poor consultation. They were not obliged to use a water-meter, but having one work as a social marker and reinforces their belongingness to their community of neighbours. Users act as per their interest, in ways that were not expected by the company's plans: they project on the revamped water supply service their own conception of its usefulness; it remains an additional source of supply to be used along with their alternative sources and storage devices.

#### **4.2 Water-metering, a methodological tool at the heart of a management situation**

The individual water-meter is a multifunctional object (Hatchuel 2000). It is an informational tool concerning water usage and heart of a managerial model (fixation of rates based on consumption) that bounds together the protagonists of our management situation: it informs

both the service provider and the user about the water consumption; it simultaneously produces a pricing signal to the user which may influence his/her consumption practices.

The focus on the water meter is of methodological interest for research on the interaction between the object and the context in which it is located. Approaching management by techniques and tools can “combine the focus on a specific object of study and what might be called an "open interest" in that object’s relationship with its context” (Chiapello & Gilbert 2009: 19-20). These authors highlight three features inherent to the object justifying its methodological interest: (1) its visible character, (2) its delimitation in space and time, and (3) its permanence in the field of observation of the researcher.

Applied to the case of Belgaum, viewing the water-meter during the time frame of the performance contract allows one to appreciate the patterns of exchange or pre-existing relationships and those that formed *a posteriori* among users, and between them and the managers of the public water service. The observation of the changes produced by the object or that it underwent through contact with the local context and of its reception constitutes the core of the research work.

### **4.3 Field survey methodology**

The purpose of the field survey is to understand to what extent the water-meter’s users appropriated the tool and how it in turn impacted their consumption practices.

The research approach retained to study the localized manifestation of tools and models of management diffused under globalization is to “locally” observe phenomena, and more precisely households’ water consumption practices in the water-metering pilot-zone in Belgaum-South.

The research methodology is based on the ‘field method’ proposed by Olivier de Sardan (1995). It consists on a hybrid approach which can be qualified as “bricolage”: it conciliates on the one hand the qualitative method and on the other hand the use of questionnaire which is normally used for statistical purposes. The qualitative method is characterized by “a situation of prolonged interaction between the researcher and the local population, so as to produce in situ knowledge, contextualized and transversal, aiming at taking into account the point of view of the actor, ordinary representations, usual practices and their indigenous significations” (ibid: 72-73).

The field survey methodology was inspired by the field of “socio-anthropology of development” as defined by Olivier de Sardan (ibid: 75). The field survey included all the four components highlighted in this field, i.e. (1) realization of participatory observations, (2) mobilization of interviews, (3) recourse to quantitative analysis, and (4) collection of written data.

The empirical findings presented resulted from two exploratory households survey in the pilot water-metering zone. The survey was based on semi-open questions completed by continuous interactions with water users and field observations. The access to the site office of Veolia and its ground level employees (plumbers, meter readers) known to the users facilitated the access to the site activity, though the survey was realized independently.

The households were selected so as to obtain a sample that covers every street of the area and a diversity of housing types representing different income groups. The neighbourhood is characterized by a diversity of habitat (from traditional houses to modern bungalows) dispersed along narrow lanes.

The first survey was conducted in September 2011, targeting 30 households which were connected to the new public water supply network in the pilot-zone. The subsequent survey,



conducted in January 2012, consisted of 15 households which were disconnected from the public water supply system due to various reasons. The results presented here are based on the survey of the first 30 households, but at times data from the 15 disconnected households has been mobilized in order to explain some phenomena.

The respondents were administered a questionnaire asking them about their water consumption and storage practices, along with their opinion of the new service. The respondent population consists of households of diverse socio-economic characteristics, thus bringing in various perspectives and enriching our data set.

The questionnaire included six themes: (1) Characteristics of the public water supply system (water definition, sources, equipment); (2) Uses of water and consumption practices; (3) Cost of water and of the devices linked to the consumption of water; (4) Water meter perception: meanings, objectives, advantages and drawbacks; (5) Water tariff: willingness to pay for water based on the actual consumption, probability of the application of the principle; (6) Water service management: quality of service of the public and the private operators, involvement of the water supply authority and the elected members; (7) “The white sheet”: any meaningful information not covered by the survey was noted down to obtain a comprehensive understanding of the water supply scenario and of its context (social, political, economical). The average duration of the interview was 1h45mn. The questions were asked in Hindi or in Kannada with the help of a water-meter reader.

The qualitative survey was an exploratory one, and the figures and statistics presented are not representative of the entire population. However, since the survey population was fairly well-balanced, the graphs and figures indicate a general trend in the groups studied.

The household survey was followed by interviews with other actors of the context, like the head of the local association, the private company providing the water service, the local municipal corporator, the meter reader and the cashier at the counter for bill payment. The objectives of these interviews were to cross-check and substantiate the data collected from the household survey, so as to make our results more robust. This fits well with the principle of triangulation wherein opinions from different actors serve to validate and uphold the results obtained during a qualitative survey.

The objective of this survey is to propose a series of empirical and descriptive typologies related to reconfiguration of the water consumption practices following the introduction of the continuous water supply service and the water-metering system.

#### **4.4 Dual use of Alternative sources of water supply**

We examine if the introduction of a new and efficient system of water supply will herald any radical changes in the collection and storage practices. People develop various storage and water collection strategies in order to cope with the intermittent and unreliable public water supply system. However, could we expect that a 24x7, pressured and regular flow would put an end to these alternate sources of water supply and storage devices being used by people?

The alternative sources of water supply for the people prior to the 24x7 implementation were private and public bore wells, their own wells, tankers and public stand posts. It was observed in the course of the survey that 13 out of the 30 surveyed households retained their alternate sources of supply. There were several reasons quoted for this continuance of alternative systems of water supply.

- There is a lack of trust in the capacity of the public authorities to continue the provision of this improved service in the long-term:

**Vijay, tailor, 10 000 Rs. /month:** “They do not have the proper knowledge. They come at 10 am and leave at 5 pm. If we call them after, they won’t be there. If we call the private at 2 pm, they will definitely come. It happened to me, at 2 pm, because the pipe had broken down. Two minutes after, they were there and worked overnight to solve the situation. The 24 hours supply continued then after, after stop of 15-20 minutes”.

- People continue using the alternative means of water supply for the sake of their maintenance as discontinuing their use might lead to a deterioration of the quality of the water source. But this motivation can be linked to the same problem as mentioned before; people don’t trust the public system in the long run, so they want to keep the old system functioning in case something wrong happen:

**Anil, auto mechanic, 7 000 Rs. /month:** “We won’t abandon our own well - if we abandon it, it will be costly to have a new one. Once we don’t use it, it gets bad water. We don’t feel like abandoning our own well because it is very old”.

- Another factor associated with the use of alternative means might be the lower cost associated with their use. It is evident that the users prefer to retain their existing sources of water so as to optimize the consumption of the 24x7 water, and hence their corresponding payment:

**Bhimrao, retired teacher, 20 000 Rs. /month:** “We keep using our own well extensively because installation is already done. If we make necessary fitting for having tap water inside- it involves a cost for installing tubes and all hurdles to install it - we don’t want to go into that. The main source is the own well, because the installation was done before. The second source is 24 hours (...) Most people are using it. We have kept using the own well because of its initial installation - but 24 hours is best. But why should we abandon our own well? This is free, and 24 hours water rate is quite high. So we keep using the own well. If rate goes down, as other people who don’t have the own well, we would only use it. The best option is to only rely on this (24 hours). Own well involves cost of maintenance - why should we spend money on that? If motor goes bad - there is a cost. But whatever we have invested in devices- we cannot abandon - we will keep using it.

- There is a reluctance to discontinue use of the alternative systems because there is a path dependency, especially when it comes to storage devices. Completely adapting the new system would entail an overhaul of existing networks and devices, which might involve higher costs in the face of already established paths/networks.
- The master concept here is reversibility (Akrich, 1992, 2006). Among many reasons, people keep their old system in place because they are not convince that the new system is not going to have the same problems of performances as the old one, hence they don’t want to accomplish an irreversible action and attach them exclusively to the public system (at least for a little less of half of the people in our sample, as 17 surveyed households didn’t retain their alternative systems of supply).

#### 4.5 Water storage practices

We investigate if the introduction of a continuous regular water supply would render the need and use of storage devices such as sumps and overhead tanks redundant. The main devices used to store water were found to be overhead tanks, sumps, barrels, ‘gadhas’ and buckets. We observe that more than half of the people in the surveyed area continue to use their storage devices, re-adapted in such a way so as to suit the new and improved water supply service despite the 24x7 water supply to their household. This overhead tank is used either to continue storing the water from their alternative means of water supply (2/30), or in some cases, to store the water from the 24x7 public water supply system (15/30). This was the most common re-adaptation observed, where a tank was being used to store water that was being supplied

continuously! Out of the 17 households that have an overhead tank, 15 of them use the tank in order to store the 24x7 water (50%), while the remaining 2 use it to store water from their own well.

The increased and steady pressure of the public water supply system enables the users to store the water in their overhead tanks without consuming any electricity. Thus, there is a decreased motivation to get rid of the old storage systems, and people continue their use.

#### 4.6 Household Typologies

The households can be categorized into three typologies based on the use of the water supply systems and storage of water:

##### 4.6.1 Complete Adoption:

Some users have completely eradicated their traditional systems of water collection and storage. They have wholly incorporated the new 24x7 water supply system into their use, irrespective of their earlier use of alternative sources.

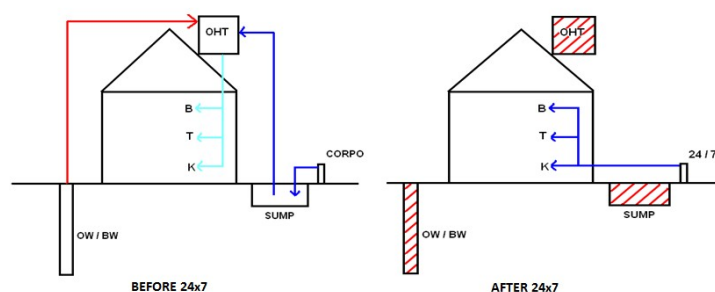


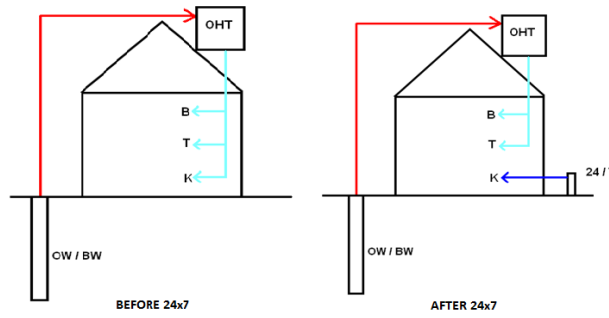
Figure 1: Complete elimination of old system and adoption of new system

Source: Data extracted from field survey (2011-2012)

Legend:
<b>OW/BW:</b> Own Well/ Bore Well - <b>OHT:</b> Overhead Tank
<b>B, T, K:</b> Bathroom, Toilets, Kitchen - <b>CORPO:</b> Corporation Water Supply - <b>24/7:</b> Water Supply post 24x7 implementation.

##### 4.6.2 Dual Use:

Some users continue to use their overhead tank to pump and store water from their alternative sources like their own well and bore well. They also simultaneously connect the 24x7 water from the public water supply system directly to their homes. The purposes of the different sources also vary, with 24x7 water being used in kitchens and own well water being used for other purposes like cleaning and washing. This depicts a typology of dual use of sources, wherein different sources of water are mobilized for different purposes, based on the need, quality and cost of the source.

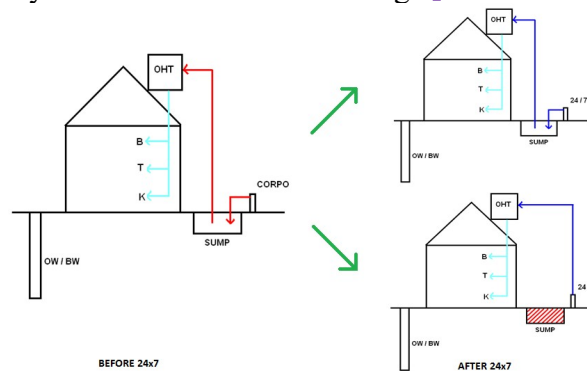


**Figure 2: Dual Use of alternative sources along with new 24x7 system**

Source: Data extracted from field survey (2011-2012)

#### 4.6.3 *Embeddedness:*

Other users have incorporated the new system completely into their old systems. The overhead tank and sump, which were earlier used to store and pump the irregular and low pressured public water (corporation water), are still being used to store the water from the new 24x7 supply system, though they have been rendered redundant. This indicates an embedding of the new system into the old system, which shows the resourcefulness of the people in adapting the new system in order to optimize their costs and minimize any discomfort due to the change.



**Figure 3: Embeddedness of new system into old storage & collection practices**

Source: Data extracted from field survey (2011-2012)

## 5. Discussion

The users are facing an unexpected management situation as far as water-metering has been imposed to them from the outside. With their limited rationality, they end-up retaining solutions that are satisfactory and not necessarily quantifiable. Their ‘detournement’ or twisting of the situation at their benefits coincides with the pursuit of the result (Girin 2011: 205) and happens to be contradictory with the purpose of the project.

Despite their high level of satisfaction about the new 24x7 water supply system, the users have not completely removed their traditional systems of water provision (overhead tanks, wells): these alternative systems supplement their use of the network-based system. They seem to be reluctant to completely shift from the existing systems to the new one. Different reasons explain their behaviour in continuing using alternative options: a reduced cost associated with the use of wells and tanks for lower quality water usages, a need to use them for the sake of maintenance, and a willingness to keep harnessing the benefits of a pre-existing investment on equipment.

Some respondents use the two systems in parallel, whereas others have completely eliminated their traditional systems. Their choice is not restricted to any income group, as people from all

income groups continue to use these alternative systems. If the rich have the greatest capacity to pay for an improved service, the tariffs they are being charged are in fact lower than their affordability. Yet, they continue their use of alternative systems along with the new system, which leads us to believe that income or affordability is not the cause for the continued use of the alternative systems, but rather a lack of trust in the capacity of the public supply to deliver a continuous service over the long-run.

Some users incorporated the water-meter in every day's consumption practices that were pre-existing to its installation. These were characterized by extensive storage practices in a context of relative water scarcity. If the improvement of the water supply duration brought by the management contract might be translated into a growing consumption, it was highly improbable that the behavioural patterns of consumption could change overnight. To that extent, the installation of the water-meter in the pilot-zone may not be qualified as a "non-event" at the user level.

The French company's assumption of the collapse of the alternative sources and storage devices by the sole insertion of water metering and its associated payment model turned to be contradicted by the users' capacity to harness the respective strength of the old and the new systems. This embedding of the old consumption practices in the new system can partly be explained by a trust in the old system that has proved to be reliable over a long period. That trust level is still stronger to the one the user has on the capacity of the public water supply service to maintain the quality of this service on a long-term basis.

## **6. Conclusion**

The introduction of water-metering and volumetric payment of water constitutes an emerging management situation for both the company and the households. This case conducted us to study a partial social phenomenon by exploring how the introduction of water-meters impacts the consumption and storage practices and how it contributes to the emergence of the notion of 'environment' which is not shared by the two protagonists. They have a different approach in dealing with a natural resource that holds different meanings to them.

The company considers water as a resource to be managed through the lenses of efficiency: billing the consumers based on their consumption contributes, from their managerial perspective, to environmental protection. Driven by the imperative of water savings and optimization of the resource, it wants its water-meters to be adopted.

The users understand water as a resource to be tapped to cater their needs. They adopt an opportunistic attitude in harnessing the potential of the revamped public water supply system and they keep mobilizing their alternative sources: they don't bet much on the permanence of the 24/7 system, due to a lack of trust in the capacity of public utilities in maintaining its service level. The environmental aspect does not appear as a concern in their discourse.

Both actors are involved in a management situation where the notion of environment is not commonly shared. The users don't refer to 'environment' in their words. They are mostly concerned about having access to sufficient water and use it as per their requirements. But, the tool ends up exerting a control over their water use as it involves a cost: before, discontinuous water was flowing through their tap without much concern on its cost; now, they keep using different sources but with a higher consideration on the financial impact.

Users approach water through the spectrum of access and consumption but not in environmental protection's terms as per the company's approach. Both the actors share in common the notion of the management of a scarce resource and act as per this situation but with distinct rationalities. The survey shows that users act as per their interest, in ways that

were not expected by the company's plans; their free willingness validates one predominant characteristic of management situations. That particular situation teaches us that the notion of environment is the result of a social construct developed overtime by organizations in charge of the management of utilities; it comforts their legitimacy in providing a service meant to contribute to environmental protection but the notion is equally shared by the end-users.

## REFERENCES

- Akrich M., 1989, « Les objets techniques et leurs utilisateurs. De la conception à l'action », *Raisons pratiques*, numéro spécial « les objets dans l'action » : 35-57.
- Akrich M., 2006, « La description des objets techniques »: in M. Akrich, M. Callon, B. Latour, *Sociologie de la traduction. Les textes fondateurs*, Paris, Ecole des Mines: 159-178.
- Akrich M., 2012, “The Description of technical objects”, in Bijker W.E & Law J. (eds.), *Shaping Technology/Building Society. Studies in Sociotechnical Change*, Cambridge, The MIT Press: 205-224.
- Bakker K., 2005, “Neoliberalizing Nature? Market Environmentalism in Water Supply in England and Wales”, *Annals of the Association of American Geographers*, Vol. 95, No. 3: 542-565.
- Barraqué B., 2005, “Not too much but not too little: the sustainability of urban water services in New York, old Paris, and New Delhi”, in: Coutard O., Hanley R.E, Zimmerman R. (eds.), *The Diffusion of Large Technical Systems*, London, Routledge.
- Barraqué B., 2005, « Eau (et gaz) à tous les étages : comment les européens l'ont eue, et comment le Tiers-Monde pourrait (ne pas) l'avoir ». Séminaire Iddri-Cerna, Accès aux services essentiels, Paris, 14th January, Personal communication.
- Barraqué B., 2001, « Infrastructures urbaines de l'eau en Inde: quels enjeux ? » in: Giordano T. (éd.), *Eau : Encadrer les partenariats public-privé*, Paris, Iddri : 9-18.
- Boxenbaum E., Battilana J., 2005, “Importation as innovation: transposing managerial practices across fields”, *Strategic Organization*, Vol. 3, No. 4: 355-383.
- Bocquet D., Chatzis K., Sander A., 2008, “From free good to commodity: Universalizing the provision of water in Paris (1830–1940)”, *Geoforum*, Vol. 39, No. 6: 1821-1832.
- Center for Civil Societies, 2007, “User charges reforms: a case study of water pricing”. *CCS Series of NURM Reforms*, No. 4.
- Chiapello E., Gilbert P., 2009, « La gestion comme technologie économique », in: Steiner P. et Velin F. (éds.), *Traité de sociologie économique*, Paris, PUF : 323-365.
- Coelho K., 2005, “Unstating the public ethnography of reform in an urban water utility in South India”, in: Mosse D., Lewis D. (eds.), *The Aid Effect: Giving and Governing in International Development*, London, Pluto Press: 171-195.
- Dumez H., 2016, *Comprehensive research: A methodological and epistemological introduction to qualitative research*, Copenhagen, CBS Press.
- Girin J., 2011, “Empirical analysis of management situations: Elements of theory and method”, *European Management Review*, Vol. 8: 197-212.
- Government of India, 2011, *Jawaharlal Nehru National Urban Renewal Mission*, Overview. <http://jnurm.nic.in/wp-content/uploads/2011/01/PMSpeechOverviewE.pdf> [last accessed on November 2011]

- Graham S., Marvin S., 2001, *Splintering Urbanism: Networked Infrastructures, Technological Mobilities and the Urban Condition*, London, Routledge (First edition).
- Hatchuel A., 2000, « Les métamorphoses de la confiance dans l'échange marchand. Petite histoire des compteurs d'eau », in Lauffer R., Orillard M. (éds.), *La confiance en question*, Paris, L'Harmattan : 353-370.
- Jaffrelot C., 2005, « L'Inde comme démocratie de marché ? », *Le Débat*, 137 : 23-31.
- Massardier et al., 2014, « Les coalitions multiniveaux d'action publique. Un modèle interprétatif des conflits pour l'eau dans les Amériques », *Cahiers des IFRE*, 1 : 63-80.
- McKenzie D., Ray I., 2009, "Urban water supply in India: Status, reform options, and possible lessons", *Water Policy*, Vol. 11, No. 4: 442-460.
- Navdanya, 2003, Al Suraksha, Adhikar, *Mukti Declaration*, 15-16th March. <http://www.navdanya.org/earthdcracy/water/jal-biradarideclaration.htm> [last accessed on November 2011]
- Renaud- Hellier E., 2007, « La gestion urbaine des services d'eau potable est-elle durable ? Réflexion sur le *modèle français* et pistes de recherche sur le terrain rennais », Travaux et documents d'ESO, Université de Rennes II - Cnrs, 26 : 67-78.
- Rottenburg R., 2009, *Far Fetched Facts. A Parable of Development Aid*, Cambridge, MIT Press.
- Shiva, V., 2002, *Water Wars: Privatization, Pollution, and Profit*, Cambridge, South End Press.
- Zérah M-H., 2003a, « Dix ans de libéralisation de l'économie indienne : les effets limités de la gouvernance dans le secteur de l'eau et de l'assainissement en ville », *Autrepart*, 27 : 91-106.
- Zérah M-H., 2003b, « Gouvernance métropolitaine et pilotage de réseaux techniques : le cas de la région métropolitaine de Mumbai », *Revue française d'administration publique*, 107 : 395-408.
- Zérah M-H., 2006, "Urban water and waste water", in: Rastogi, A. (Ed.), *India Infrastructure Report 2006*, Mumbai, Oxford University Press: 130-159.